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ABSTRACT

The history, management, and importance of Alaska's fisheries are the focus of this elementary school unit. Through the science, social studies, English, mathematics, and art activities included, students investigate Alaskan fisheries and the biology and ecology of commercially important fish species. Among the topics covered are tides, life cycles, fishing methods, and sea legends. A bibliography and set of field trip suggestions are provided. (WB)

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Alaska Sea Grant Program

ALASKA SEA WEEK CURRICULUM SERIES
FIFTH GRADE

AUG 1981
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Fish

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SE 035 511

UNIVERSITY OF ALASKA

FISH

A Study Guide for the Fifth Grade

The materials in this section were originally written by:
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Supporting materials developed by:
Juneau Teachers and the South East Regional Resource Center

Edited by:
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ALASKA SEA WEEK CURRICULUM SERIES

Field-test edition March 1980
First reprint June 1980

ACKNOWLEDGEMENTS

Sea Week began in the early 1970's in Juneau, Alaska. Under the leadership of Mary Lou King, parents, teachers and agency personnel started taking elementary school students down to the sea every spring. Soon, Sea Week was an annual event with some of the junior high and high school students assisting the younger pupils on their field trips to beaches, wetlands, forests and glaciers. In 1978, a K-6 Sea Week curriculum was written with the assistance of Juneau teachers, scientists, fishermen, parents, and government employees - a true community effort. In 1979, the Southeast Regional Resource Center revised the material, adding worksheets and graphics and reworking certain activities. In 1980, endorsed as "The Year of the Coast" by President Carter, it seems very fitting that the Alaska Sea Grant Program is initiating a program to spread Sea Week statewide.

This first statewide edition is a product of Juneau - its people and environment. We would like to express our deep appreciation to the many foresighted people who contributed to Sea Week and especially to all the students who are the reason and impetus behind its success. Special thanks to Mary Lou King, Nancy Barr, Janie Cesar, Carol Koski, Dick and Betty Marriot, Virginia Eggert, Claudia Kelsey, Kathy Hanna, James G. King, Lynn Szepanski, Karen Gunstrom, Mary Beth Parsons, Dan Hopson, Kristi Kantola, Pat Thrasher, Tamara Smid, Judy Maier, Jerry Hard, Marty Early, Jan Conner, Mark Hansen, the Alaska Department of Fish and Game, the Alaska Coastal Management Program, the United States Forest Service, the Alaska Department of Environmental Conservation, the United States Fish and Wildlife Service, and the South East Regional Resource Center.

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PREFACE

The Alaska Sea Week Curriculum Series (K-6) emphasizes one or more aspects of the marine environment at each grade level. Kindergarten materials, for instance, are intended to introduce students to the exciting and curious world of the sea and shore. At the other end of the series, materials for sixth graders stress man's interactions with the marine environment. While the subject matter at each grade level is unique, as a whole the grade level guides will yield a broad understanding of the marine environment and its importance to Alaskans.

The purpose of this curriculum series is to help the teacher in interpreting the marine environment for elementary school students. However, what is included here is just a place to begin. As you read the following materials, you will find factual information about many aspects of the marine environment, and suggestions for presenting these concepts to students through multi-disciplinary activities both in the classroom and at field sites. Materials are organized into units, each covering a single idea or subject. From these you, the teacher, may select the units and activities which are best suited to your class, community and resources.

"Sea Week" originated in Juneau, and these curriculum materials are most applicable to southeast and southcentral Alaska. However, the Alaska Sea Grant Program has funded a three year pilot project to expand Juneau's successful program statewide. As Sea Week is piloted in 14 communities around the state, the Curriculum Series will be expanded to meet the needs of western, interior, and northern Alaska.

Send us your comments and suggestions. The strength of the final edition will depend not only on those of us staffing the project - but on you - your ideas and comments. After you've tried some of these activities - fill out and send in the evaluation sheet at the back of this book. Thanks so much!

Jill Thayer/Belle Mickelson, Coordinators
Mary Lou King/Nancy Barr, Consultants
Alaska Sea Grant Program
University of Alaska, Fairbanks, AK 99701
479-7631/7086

INTRODUCTION

Alaska has more than 33,000 miles of shoreline; the earth's circumference is only about 25,000 miles. Much of Alaska's complex and intricate shoreline is accounted for by the bays, inlets, headlands, islands of Southeast Alaska. Here, in Alaskan communities large and small we live in close contact with the marine world. Some of us make our livings by fishing or working for the Coast Guard, the State's marine transportation system, or marine shipping companies. Most of us spend at least some of our time sport fishing, digging clams, beachcombing, or just gazing out at the incredible scenery of snowcapped mountains and everchanging inland waters.

The dynamic marine environment of which we are a part is our heritage, our trust. It is only fitting that our children know that world intimately so that they can grow up in an understanding of its complexities, it subleties, its importance. This is of particular urgency now that Alaska is facing increasing pressures to make decisions that will effect the use of her lands and seas for generations to come. We, and our children, must have a part in the decision making processes and the more knowledgeable we are, the more effective our participation will be.

Teaching children about the world in which they live is important and perhaps it has never been more important than it is in Alaska today. Teaching facts and concepts about the marine world is important but perhaps most important of all is the teaching of attitudes. It is hoped that through the study of marine life, students may gain the following:

1. An increased interest in their environment.

2. A greater awareness, appreciation, respect for the natural world that is so close about them here in Alaska.

3. The sheer delight, pleasure, happiness that can come from observing and understanding nature close up.

4. A sensitivity to the relationship between themselves and their environment.

If that can be accomplished, all our lives will be better because of it....

INTRODUCTION - FIFTH GRADE

No one doubts the importance of fish and fisheries in Alaska. Even a quick look at statistics will show you their value to Alaskans and to the nation. In 1978, for example, the Alaskan commercial catch of fish and shellfish totaled more than 800 million pounds and had wholesale value of more than a billion dollars. Salmon make up about half of that total - both in pounds and dollars - and crab, shrimp, halibut, and other fish made up the rest. To catch and process Alaska's fishery resources and to regulate the state's fisheries requires the work of many people. Although an exact figure is hard to derive, it is estimated that at least 45,000 men and women have jobs that are related to Alaskan fisheries.

At lower grade levels in the Sea Week Curriculum, students have been introduced briefly to some of the common fish of Alaska's shallow marine waters. In 5th grade, they will for the first time focus specifically on Alaska's fisheries - their history, management, and importance - and on the fish that support them.

Through the study fifth graders may learn the following:

1. The basic anatomy of a fish

2. The names and life histories of fish with commercial importance in Alaska.

3. The importance and use of fish as a food.

4. The methods used to catch fish, both commercially and for sport.

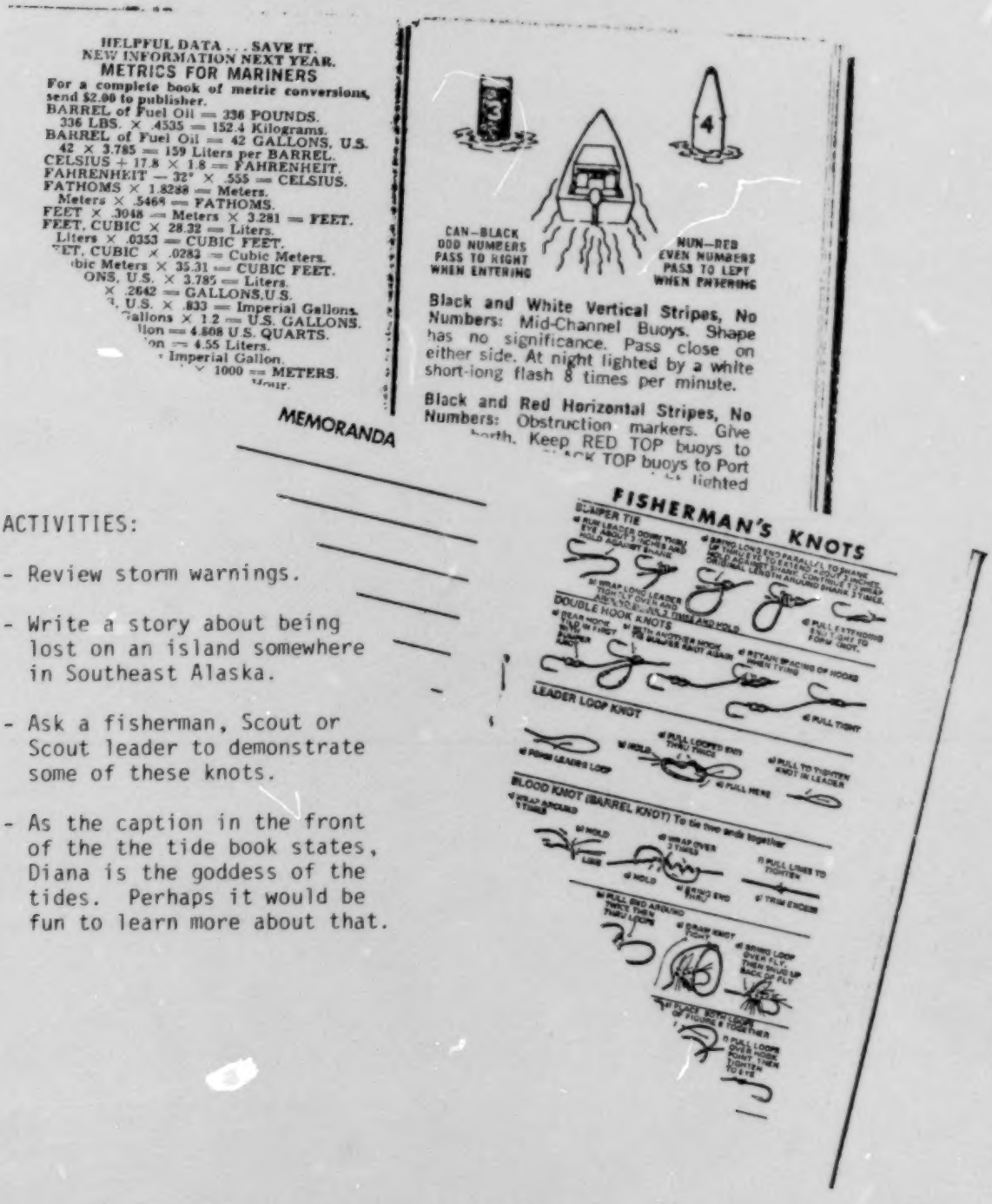
5. The increasing role of hatcheries in Alaska.

6. The significance of fish and shellfish to Alaska natives - both as food and as a part of their legends and history.

The activities suggested for use in the teaching of these ideas are multi-disciplinary. They involve experiences in math, english, science, music, and art. Undoubtedly you the teacher will find additional ways to incorporate the skills your students are learning with the ideas suggested for consideration in this unit.

KNOWING THE TIDES

As a prerequisite to any SeaWeek activity, your students should be able to use the tide book. To become familiar with the tide book, perhaps it would be useful to thumb through it and note the different sections included. The tide tables themselves are just one part. Storm signals, a buoy guide, metric conversion chart, radio frequencies, motor boat regulations, and a guide to fishermen's knots are also included.


HELPFUL DATA . . . SAVE IT.
NEW INFORMATION NEXT YEAR.
METRICS FOR MARINERS
For a complete book of metric conversions, send $2.00 to publisher.
BARREL of Fuel Oil = 336 POUNDS.
336 LBS. × .4535 = 152.4 Kilograms.
BARREL of Fuel Oil = 42 GALLONS, U.S.
42 × 3.785 = 159 Liters per BARREL.
CELSIUS + 17.8 × 1.8 = FAHRENHEIT.
FAHRENHEIT − 32° × .555 = CELSIUS.
FATHOMS × 1.8288 = Meters.
Meters × .5468 = FATHOMS.
FEET × .3048 = Meters × 3.281 = FEET.
FEET, CUBIC × 28.32 = Liters.
Liters × .0353 = CUBIC FEET.
FEET, CUBIC × .0282 = Cubic Meters.
Cubic Meters × 35.31 = CUBIC FEET.
GALLONS, U.S. × 3.785 = Liters.
Liters × .2642 = GALLONS, U.S.
GALLONS, U.S. × .833 = Imperial Gallons.
Imperial Gallons × 1.2 = U.S. GALLONS.
1 Liter = 4.808 U.S. QUARTS.
1 Liter = 4.55 Liters.
1 Imperial Gallon.
1000 = METERS.
MEMORANDA
CAN—BLACK ODD NUMBERS PASS TO RIGHT WHEN ENTERING
NUN—RED EVEN NUMBERS PASS TO LEFT WHEN ENTERING
Black and White Vertical Stripes, No Numbers: Mid-Channel Buoys. Shape has no significance. Pass close on either side. At night lighted by a white short-long flash 8 times per minute.
Black and Red Horizontal Stripes, No Numbers: Obstruction markers. Give
TOP buoys to Port
lighted
FISHERMAN'S KNOTS
BLIMPER TIE
DOUBLE HOOK KNOTS
LEADER LOOP KNOT
BLOOD KNOT (BARREL KNOT) To tie two ends together

ACTIVITIES:

- Review storm warnings.
- Write a story about being lost on an island somewhere in Southeast Alaska.
- Ask a fisherman, Scout or Scout leader to demonstrate some of these knots.
- As the caption in the front of the the tide book states, Diana is the goddess of the tides. Perhaps it would be fun to learn more about that.

- Tide tables and the metric conversion charts can be the beginnings of some fine arithmetic problems. Students can convert knots to kilometers to miles. Math problems with leagues and fathoms might be fun.

READING THE TIDE TABLES:

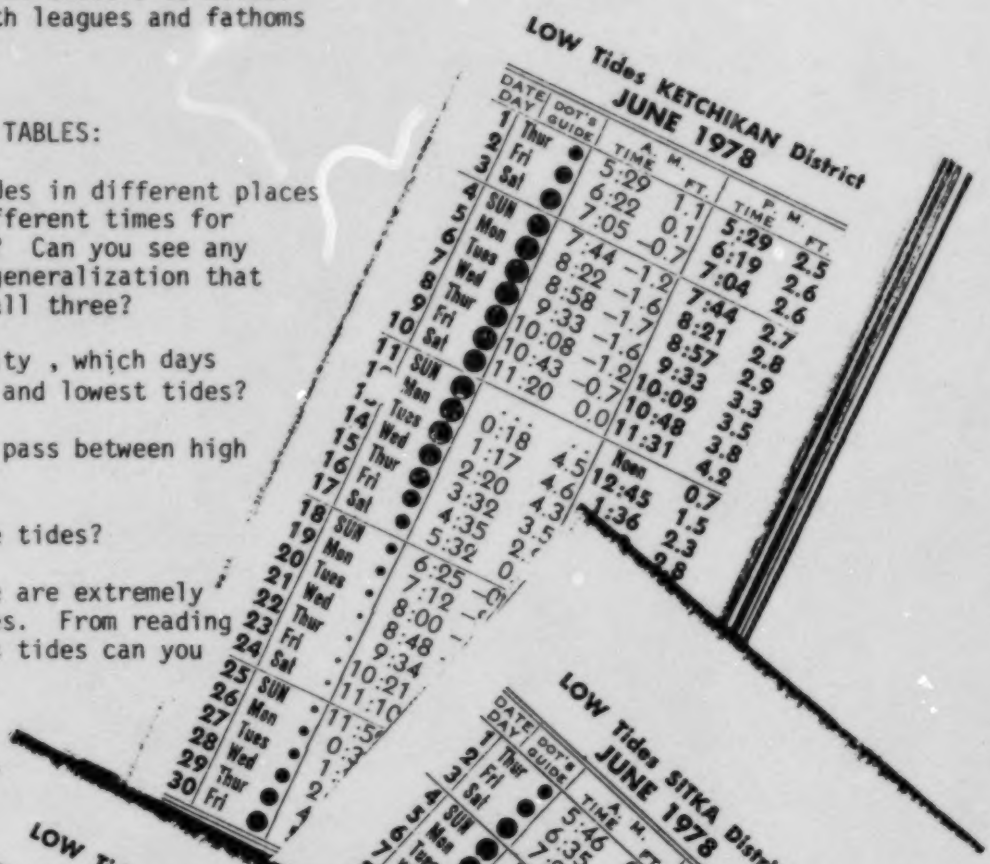
- Compare the tides in different places Why are there different times for different places? Can you see any relationship or generalization that can be made for all three?

- In your community , which days have the highest and lowest tides?

- How many hours pass between high and low tides?

- What causes the tides?

- Sometimes there are extremely high and low tides. From reading about what causes tides can you figure out why?



LOW Tides KETCHIKAN District
JUNE 1978

DATE	DAY	DOT'S GUIDE	A. M. TIME	A. M. FT.	P. M. TIME	P. M. FT.
1	Thur	●	5:29		5:29	
2	Fri	●	6:22	1.1	6:19	2.5
3	Sat	●	7:05	-0.7	7:04	2.6
4	SUN	●	7:44	-1.2	7:44	2.6
5	Mon	●	8:22	-1.6	8:21	2.7
6	Tues	●	8:58	-1.7	8:57	2.8
7	Wed	●	9:33	-1.6	9:33	2.9
8	Thur	●	10:08	-1.2	10:09	3.3
9	Fri	●	10:43	-0.7	10:48	3.5
10	Sat	●	11:20	0.0	11:31	3.8
11	SUN	●				4.2
12	Mon	●			Moon	
13	Tues	●			12:45	0.7
14	Wed	●	0:18		1:36	1.5
15	Thur	●	1:17	4.5		2.3
16	Fri	●	2:20	4.6		2.8
17	Sat	●	3:32	4.3		
18	SUN	●	4:35	3.5		
19	Mon	●	5:32	2.(		
20	Tues	●	6:25	-0.		
21	Wed	●	7:12	-0.		
22	Thur	●	8:00	-0.		
23	Fri	●	8:48			
24	Sat	●	9:34			
25	SUN	●	10:21			
26	Mon	●	11:10			
27	Tues	●	11:5			
28	Wed	●	0:3			
29	Thur	●	1:3			
30	Fri	●	2:			

LOW Tides SITKA District
JUNE 1978

DATE	DAY	DOT'S GUIDE	A. M. TIME	A. M. FT.	P. M. TIME	P. M. FT.
1	Thur	●	5:46		5:34	
2	Fri	●	6:35	0.6	6:26	2.0
3	Sat	●	7:20	-0.1	7:10	2.2
4	SUN	●	7:59	-0.7	7:49	2.4
5	Mon	●	8:34	-1.1	8:26	2.6
6	Tues	●	9:09	-1.4	9:03	2.7
7	Wed	●	9:45	-1.4	9:40	2.8
8	Thur	●		-1.3	10:18	3.1
9				-1.1	10:59	3.2
10				-0.8	11:43	3.4
				-0.3		3.5
			12:10			
			12:53	0.2		
			1:39	0.8		
			2:33	1.3		
			3:32	1.8		
			4:31	2.2		
			5:30	2.4		
			6:25	2.3		
			7:18	2.1		
			8:08	1.9		
			9:00	1.8		
			:51	1.7		
			:46	1.7		
			:44	1.8		
			10	-1.3		
			5	-0.3		
			2	0.8		
				1.7		
				2.4		
				2.8		
			Sit-4			

LOW Tides JUNEAU District
JUNE 1978

DATE	DAY	DOT'S GUIDE	A. M. TIME	A. M. FT.	P. M. TIME	P. M. FT.
1	Thur	●	5:54		5:58	
2	Fri	●	6:47	1.0	6:49	2.6
3	Sat	●	7:29	-0.9	7:32	2.6
4	SUN	●	8:11	-1.5	8:11	2.6
5	Mon	●	8:46	-1.9	8:49	2.7
6	Tues	●	9:21	-2.0	9:25	2.8
7	Wed	●	9:56	-1.8	10:01	3.2
8	Thur	●	10:31	-1.5	10:38	3.5
9	Fri	●	11:08	-0.9	11:16	3.9
10	Sat	●	11:45	-0.1	11:58	4.4
11	SUN	●				
12	Mon	●			12:24	0.8
13	Tues	●	0:46		1:09	1.7
14	Wed	●	1:45	4.7	2:00	2.6
15	Thur	●	2:51	4.8	2:59	3.2
16	Fri	●	4:00	4.5	4:02	3.5
17	Sat	●	5:05	3.7	5:04	3.4
18	SUN	●	6:00	2.3	6:00	3.0
19	Mon	●		0.7		
20	Tues	●	6:52		6:55	2.4
21	Wed	●	7:39	-1.1	7:45	1.7
22	Thur	●	8:25	-2.7	8:33	1.2
23	Fri	●	9:12	-3.9	9:21	0.8
24	Sat	●	:58	-4.6	10:11	0.8
25	SUN	●	10:44	-4.7	11:02	1.0
26	Mon	●	11:31	-4.2	11:57	
27	Tues	●		-3.2		
28	Wed	●	0:56		12:2	
29	Thur	●	2:00	1.9		
30	Fri	●	3:1			

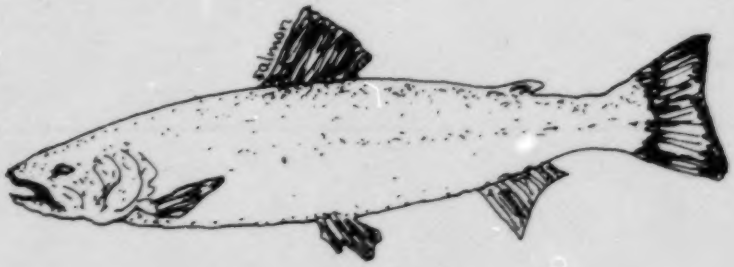
WHAT IS A FISH?

Ichthyology(ichytno = fish logy = words) is the study of fish. Fish are defined as aquatic, gill-breathing vertebrates equipped with fins. Over the generations, many species of fish have become extinct as their environments change and they do not. Living fish are usually divided into three groups:

1. Fish that lack jaws and paired fins (same fins on both sides of the body) but have "pouched" gills. Lampreys and hagfish are in this group.

2. Fish with "plate" gills (with wall-like artitions between gill chambers), movable jaws, paired appendages of cartilage and backbones of cartilage. Sharks and rays are members of this group.

3. All more developed fish having movable jaws, paired fins and bony skeletons are members of this group.



Most of the fish we see in this area belong to the last group. The Wildlife Notebook Series leaflets give a detailed account of some local fish.

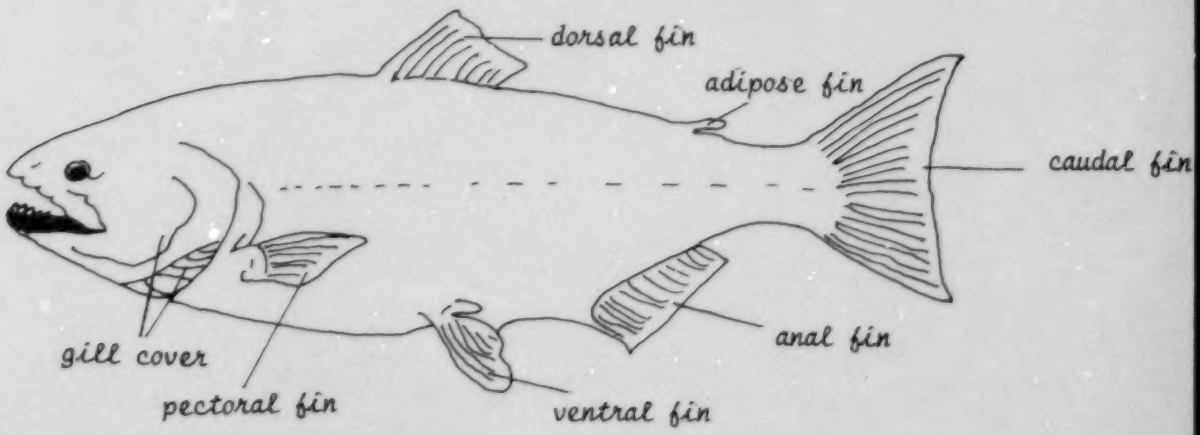
ACTIVITIES:

- Students could do a report on a group of fish.

- After learning some differences between herring and salmon, students might write a skit and make costumes for a presentation concerning life cycles, fishermen trying to catch them, etc.

EXTERNAL STRUCTURE OF A FISH

There are several reasons why people bother to learn the names of the external features of a fish. For one, many species have differences in one fin or another. The shark, for example, may have a caudal fin design which distinguishes it from other sharks. Secondly, biologists mark tagged salmon by removing the adipose fin. (Not all species of fish even have adipose fins!) These are just two of the reasons for this type of study.



ACTIVITIES:

- If you can't get hold of some preserved fish, wear your old clothes and study some fish you have collected. If you work with fish you collect, note the slime or mucous-life membrane that covers its body. This slime is important to the health of the fish. See if you can find out why.

- Science groups might label the fish's external features and describe how fins are used for swimming. OBIS (a University of California outdoor science program) has an activity on animal movement in water which might be appropriate. (See the bibliography for more details on OBIS.)

- OBIS also has a project called "Attract a Fish." Students experiment with colors, shapes, etc. that attract fish. They get to make their own lures.

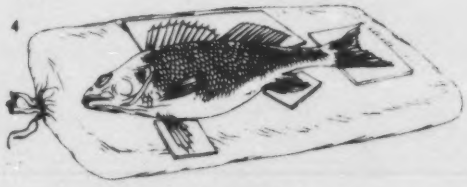
- Clean and dry the exterior of a fish and try making fish prints. The instructions that follow are from The Lore of Sportfishing.

GYOTAKU - JAPANESE FISH PRINTS

1. Wash the fish thoroughly with detergent or rubbing alcohol to remove all trace of skin mucous, blood, etc. Rinse with fresh water until all the detergent is removed.

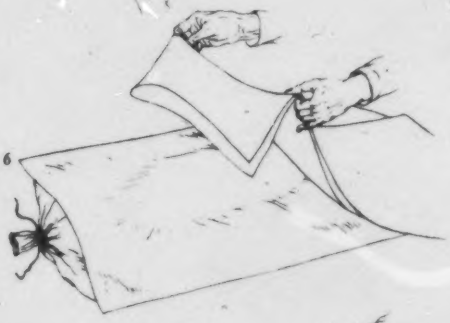
2. If there is any chance of the fish spoiling before you are finished printing, the viscera should be removed.

3. The fins of dead fish tend to fold down. A pin or small nail is thrust into the muscular base of one of the foremost spines. The spine thus erected will pull the remaining spines along. Then formalin or alcohol should be applied.



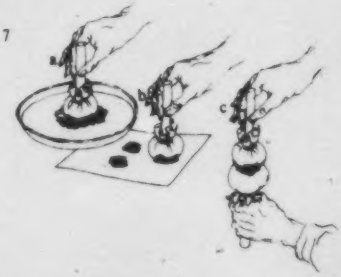
4. A bag filled with wet sand is used to hold the fish firmly during printing. Thin pieces of wood or cardboard can be placed beneath the fins to hold them steady and well spread.

5. Another popular way to fix the fish is to split the fish into halves and put the upper half on a wooden board where it is fastened with pins or small nails.



THE INDIRECT METHOD:

6. In the indirect method, a sheet of thin rice paper is applied to the surface of the fish and on top of that a thin damp towel which is removed when the paper is sufficiently moist.



7. Paint or Chinese ink is spread on a plate and a tampo is dipped into it. The amount of paint or ink absorbed by the tampo is tested by touching it to a piece of paper. A large tampo can be used as a stamp pad.

8. Touch the paper very lightly with the tampo, using a stroking motion. Use a smaller tampo to bring out details.

9. To keep the color from overflowing, place a strip of paper along the outline of the fish body on top of the print paper.

9

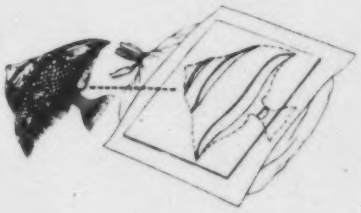
10. To remove the rice paper from the fish, first gently moisten the back of the fins with a wet brush. After a while moisture will spread from underneath and the paper will easily let go from the fish body.

10

11. For a print to achieve the impression of two fish swimming side by side, make a print in the normal way. Then make an extra print and cut it out with scissors. Place the second print partly on top of the first. The final printing procedure is then followed.

11

12. In case the fish has dark spots or stripes, a firm but not too thick paper with appropriate cutouts should be used as a stencil. Place this on top of fish. The cutouts are then filled with paint or ink with a brush or tampo.



12

13. If the fish has white or light colored spots, identical pieces of paper should be cut out and put over such spots so they show when the rice paper is removed.

13

THE DIRECT METHOD:

14. In the direct method, paint or ink is applied directly to the fish with a flat brush; a hard brush for oils or a soft brush for watercolors.

14

15. If the concave part of the fins is to be accented, the brush should be moved from the tail toward the head.

16. If the convex part of the fins is to be accented, the brush should be applied from head to tail.

16

15

17. A piece of rice paper is now carefully placed on the fish and rubbed by the fingers all over the surface of the fish.

18. Accentuate details with a thin brush.

19. If the fish has light spots, proceed in the same manner as described in sketch 13.

THE TRANSPLANTING METHOD:

20. In the Tensho-ho or transplanting method, oil is smeared on top of the fish. With some sort of transparent material, nylon, polyethylene, etc., an imprint can be made.

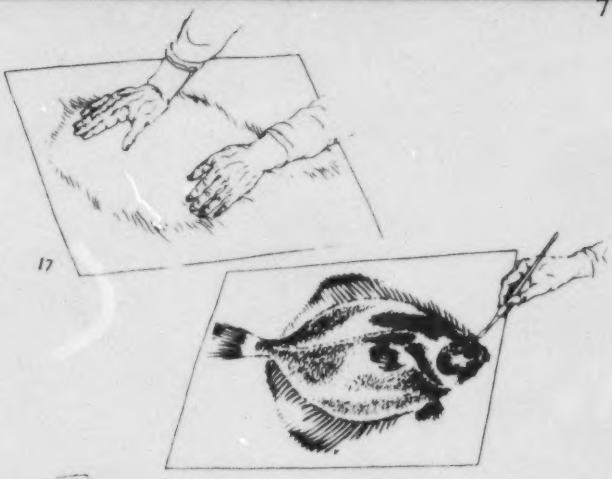
21. The imprint can now be transferred to other objects such as lampshades, leather, books, etc.

22. In the "quick method," a sheet of thin paper is pressed against the surface of the fish. Ink, paint or watercolor is then applied with a tampo or brush as in the direct method.

23. A rice paper is pressed against the first paper and then is treated as in the direct method.

24. In making prints of hard surfaces such as shells, rocks, etc., a layer of glue is first applied.

25. A carbon paper is now pressed upon the surface with the carbon side out. A thin paper is pressed again the carbon paper and the impression is created by rubbing with a hard object such as the bowl of a spoon.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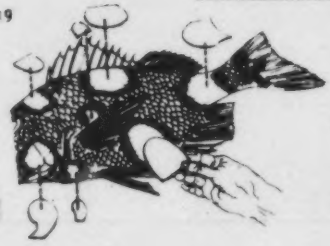
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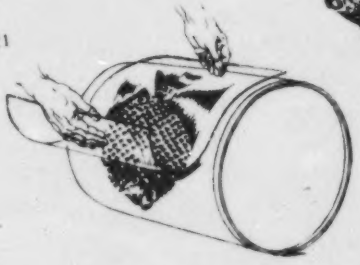
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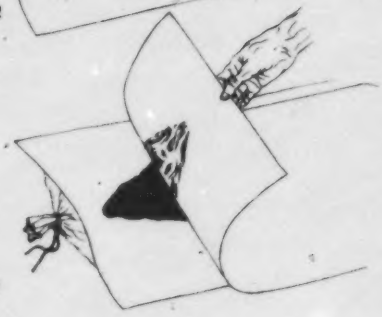
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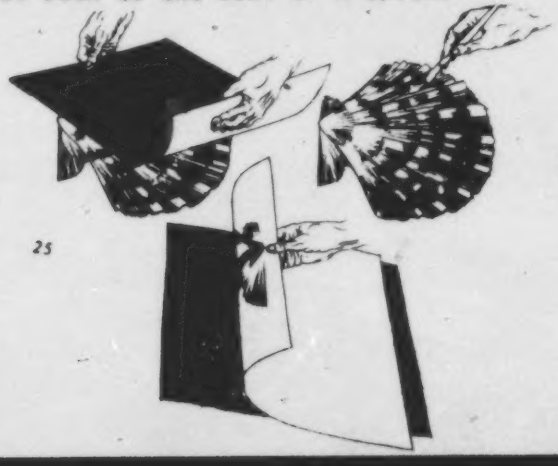
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A LOOK INSIDE!

How about some dissecting! This is good practise for learning exactitude and care. Students will know how to use some tools of biology, as well. Check any biology text or high school experiment workbook for instructions on dissecting. Perhaps you might be able to "borrow" a high school biology student to lead this activity.

Some things to look for:

1. Gills - OBIS has a fine activity on water breathers. "When aquatic animals move underwater, they create a variety of currents. These include currents caused by swimming, feeding and breathing. These currents are usually difficult to observe because of the lack of color contrast between currents and the surrounding water. You can solve the 'invisible current' problem by using diluted food coloring, which safely passes through animals that actively pump water through their bodies."

OBIS activity cards include lists of materials needed, background information, any preparation needed, actions, stimulating questions and a list of other related activity cards.

2. Skeletal structures - Note how fins are attached. Students might count vertebrae.

3. Nervous system - The fish's system is basically divided into three parts (brain and spinal cord; cranial nerves in charge of smelling, hearing, seeing and balance; the autonomic or automatic nervous system). Perhaps students could locate the brain and see how and where it is connected to the rest of nervous system.

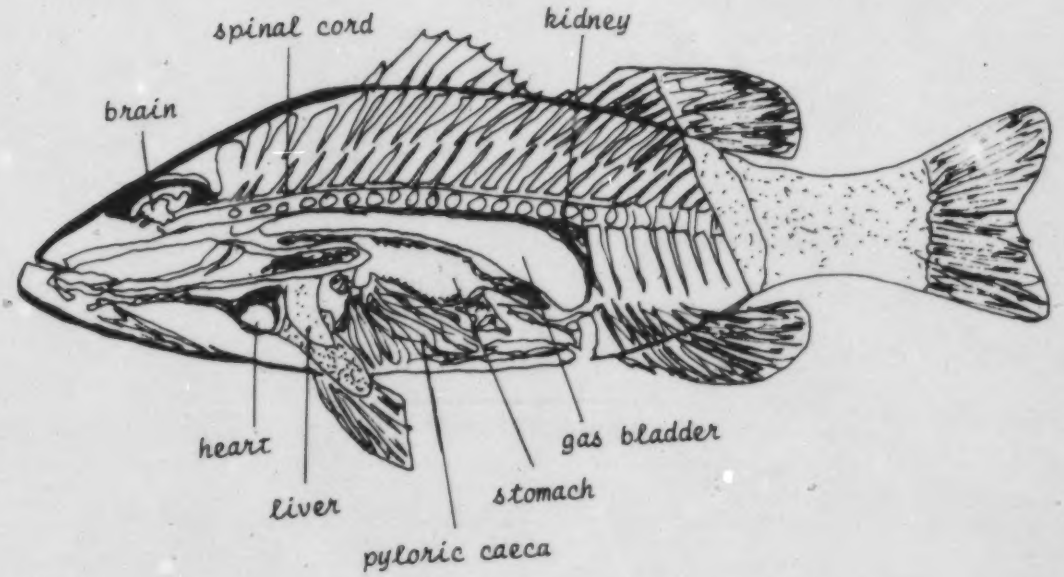
(A LOOK INSIDE,cont.)

4. Gas bladder, also known as the swim bladder - This organ acts to regulate pressure by releasing and reabsorbing gas through a special structure in the bladder wall. This allows the fish to travel at varying depths without difficulty. The gas bladder can also act as a weight regulating device, sound receptor and producer and secondary breathing organ.

5. Heart - The fish heart is constructed to perform only single circulation. This means that blood returning to the heart passes through the fish's one atrium and one ventricle and is then propelled toward the gills for aeration. After that, the blood continues directly on to the rest of the body.

Mammals have double circulation. That is, blood goes to the heart which pumps it into the lungs for aeration. Then blood returns to the heart to be pumped throughout the body.

6. Pyloric caeca - These serve as part of the fish's digestive tract.



SALMON

One of the greatest natural phenomena in our part of the world is the salmon. All five Alaskan species live for a time in the ocean and then return to the freshwater stream of their birth to spawn and die. But why are there five species? Each one has traits that make it a separate kind of fish. Each one has its own special environment and niche.

Please check the Wildlife Notebook Series for the different habits and habitats for each species of salmon. The chart below illustrates some of that information very simply.

species	typical spawning areas	average number of eggs	time immature fish spend in freshwater	average adult weight	maximum weight	average life cycle
SOCKEYE	coarse gravel in riffle area, streams with lake in watershed	4,000	1 - 3 years	5 lb.	16 lb.	4 years
KING	large river systems, deep water and coarse gravel	8,000	1 year	35 lb.	126 lb.	4 or 5 years
COHO	riffle area	5,000	1 - 4 years	10 lb.	21 lb.	3 - 5 years
CHUM	short distance from ocean in many types of gravelly areas	4,000	several weeks	11 lb.	30 lb.	3 - 4 years
PINK	small streams - over medium gravel	2,000	several weeks	4 lb.	12 lb.	2 years

ACTIVITIES:

- Students can use this information to make life cycles for each species as shown on the following pages.

- Students can prepare a game of chance concerning salmon life cycles.

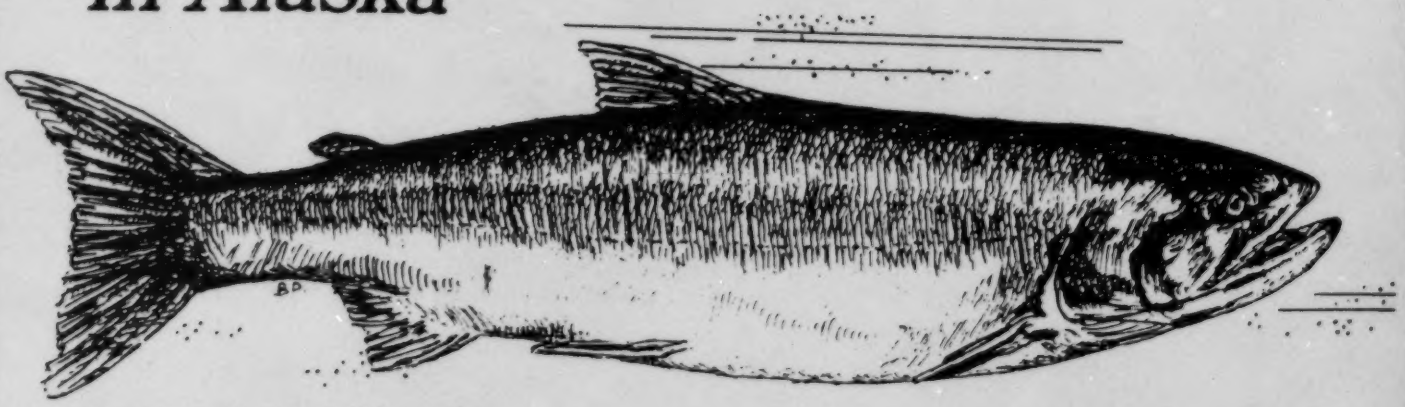
- Crossword puzzles can be made for each stage of a salmon's life.

- Students might research salmon migration patterns at sea.

- Streams of the Juneau-Douglas area could be placed on a map and habitats of each species could be pinpointed on the map.

- Have the students decide which would be the best salmon to raise in hatcheries if they were interested in fast production.

the **SOCKEYE SALMON** *in Alaska*



Alaska Department of Fish and Game
Wildlife Notebook Series

THE ANADROMOUS SOCKEYE, or red salmon *(Oncorhynchus nerka)* (Walbaum), is native to the Pacific coastal waters from Point Hope, Alaska, south to the Klamath River in California. The sockeye, or "blue back" as it is called on the Columbia River, has long been regarded as one of the most important commercial fish on the Pacific Coast, and in recent years, its potential as a sport fish has also been recognized.

GENERAL DESCRIPTION: Ocean-fresh sockeye are metallic greenish-blue on the dorsal surface with fine black specklings. The large black spots which are found on the backs of the silver, king and pink salmon are completely lacking on sockeye. The sides are silvery, blending to white on the underbelly.

The mature male in fresh water is distinguished by its humped back, hooked upper jaw and brilliant red coloration on the back blending to a deep, dark red on the sides. The head is olive-green and the lower jaw and underside are pale white. The ventral, pectoral and caudal fins are metallic green. The mature female in fresh water lacks the humped back and the hooked jaw and usually has greenish-yellow blotches on the sides, in addition to the dark red.

Sockeye young are recognized by their dark, mottled green back blending to an iridescent green and silver on the sides. There are six to ten dark oval parr marks on the sides that are about the same length as the width of the eye. The parr marks barely extend below the lateral line and are irregularly spaced along the side of the body.

LIFE HISTORY: In early summer, adult sockeye migrate from salt water back to the freshwater stream system where they originated. The system normally has a lake. Usually the adults pass through the lake and spawn in its tributaries. Some, however, spawn in the lake outlets and others utilize the lake margin (beach spawners).

While at sea, sockeye are bright and silvery. In fresh water the adults acquire the characteristic red coloration. The complete maturation process requires one or two months and by late summer they are in full color and ready to spawn.

Upon entering the spawning area, the female digs a nest, or redd, with her tail fin. The eggs are deposited in the downstream portion of the redd and are fertilized by one or more males. During the spawning act, the female continues to enlarge the redd upstream and thus covers the eggs previously deposited. Both males and females die after spawning, usually within two weeks.

During the fall and winter, the eggs develop into sac-fry, or alevins. These tiny fish live in the gravel, utilizing the food materials contained in the yolk of the egg. The young fry move into lakes in early spring and spend one or more years in fresh water before migrating to sea in the spring as smolts. The migration of smolts to salt water usually ends by midsummer.

After two to four years in salt water, mature fish usually have attained weights varying from four to eight pounds, but weights up to 15.5 pounds have been recorded. In Alaska, it is usually during the fourth, fifth or sixth year of life that the fish return to fresh water to spawn. Some males mature after spending only one year in salt water and return as "jacks."

Each year more and more people take up the challenge of sport fishing for sockeye. Their rewards include fast action, beautiful scenery and excellent eating from one of Alaska's finest fish.

COMMERCIAL FISHERY: The sockeye, commonly referred to as "money-fish" by commercial fishermen, is one of Alaska's most valuable resources. The average yearly catch from 1955 to 1971 was worth approximately $16.4 million, or over twice the original purchase price of Alaska.

The primary sockeye production area of the State is Bristol Bay, which is also the largest single sockeye-producing area in the world. The central, southeastern and northwestern regions of the state also have sockeye runs which contribute significantly to the commercial fishery.

The most common methods of commercial fishing for sockeye are drift gill net (Bristol Bay and Cook Inlet primarily), purse seine and set gill net.

In some areas of the state, major sockeye runs were reduced by earlier exploitation of the fishery and biological conditions limiting productivity, so that only tokens of the original runs remain today. The Department of Fish and Game has initiated programs to restore these valuable salmon stocks. Restoration of sockeye runs and establishment of new sockeye stocks are perhaps among the most difficult and challenging problems to be solved by department biologists.

FOOD HABITS: The major freshwater food of young sockeye is minute planktonic crustacea although insects are occasionally eaten. The first gill arch in the throat region of the fish has 30 to 40 long, fine gill rakers which strain the food organisms from the water passing through the gills. Once in the ocean, the young sockeye feed voraciously on marine planktonic forms, chiefly small crustaceans. Adult salmon discontinue feeding upon re-entry to fresh water.

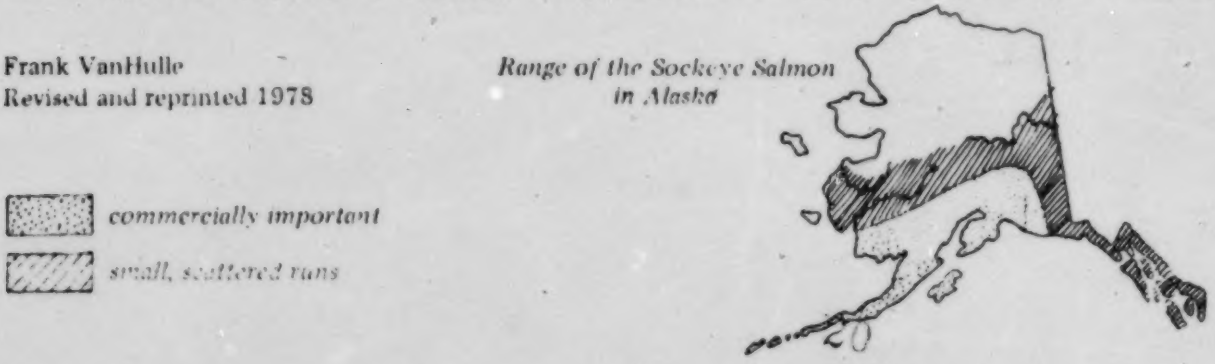
SPORT FISHERY: Sport fishermen seldom hook the sockeye while in salt water, but catch them just after their return to fresh water. They are generally considered to be unpalatable after attaining a bright red coloration. The deterioration of flesh quality is due to the fish utilizing its stored oils and minerals once it has ceased to feed.

KOKANEE: Occasionally a segment of the lake-rearing population of sockeye salmon fail to migrate to sea. This may occur out of "choice" or a physical barrier may prevent the normal seaward migration. When this occurs, a landlocked population of sockeye salmon called Kokanee may develop.

These fish exhibit all of the physical characteristics of anadromous sockeyes with the exception of size: the Kokanee rarely exceeds 14 inches in length. The life history of these "landlocked" salmon is the same as their anadromous counterparts; however, the ocean phase of their life cycle is absent, therefore they do not contribute to our commercial fisheries. Where they occur, Kokanee salmon are highly valued as sport fish and have been introduced in cold-water lakes and reservoirs in Alaska and many of the lower 48 states.

Frank VanHulle
Revised and reprinted 1978

Range of the Sockeye Salmon in Alaska



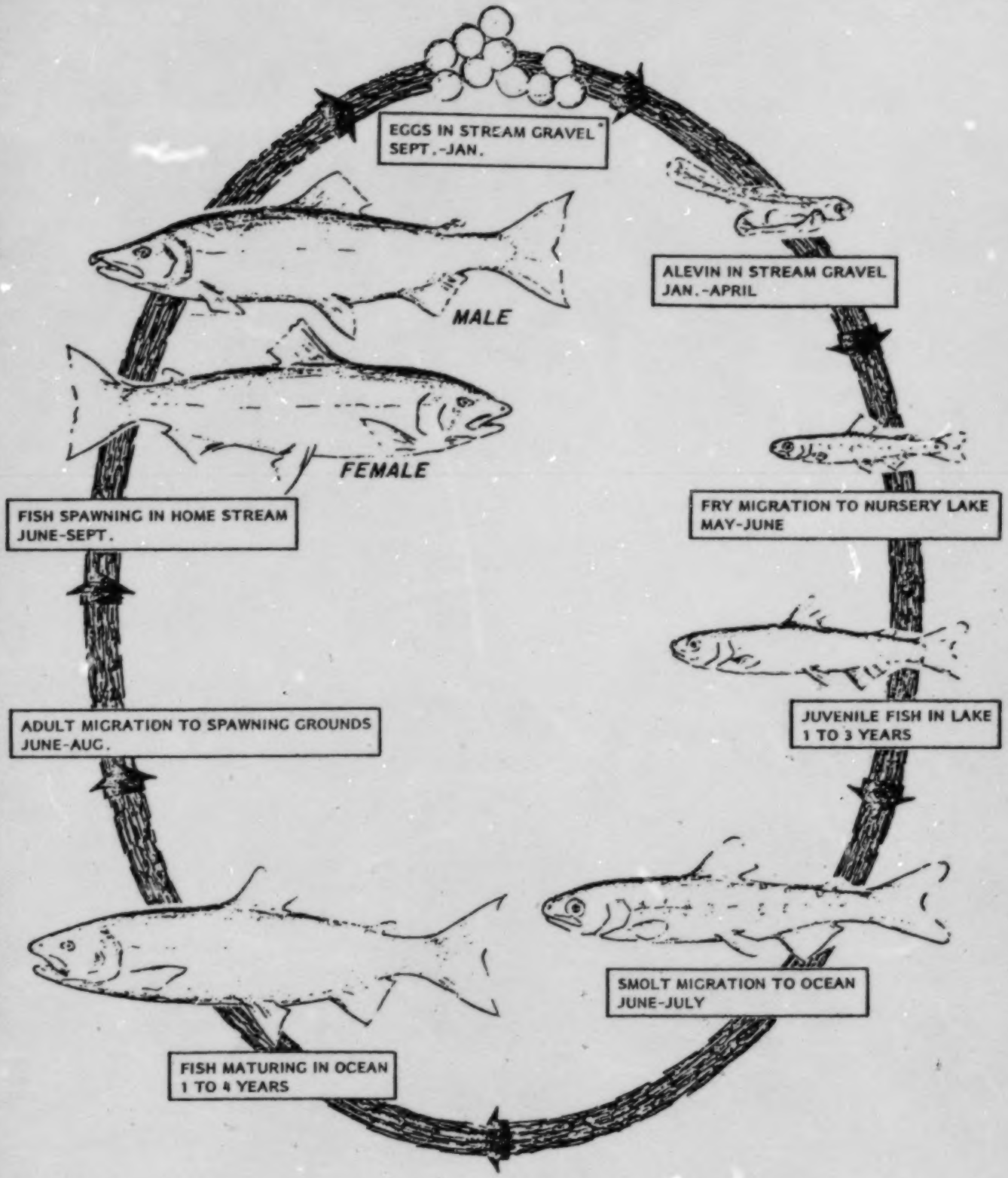


Figure 7.--Life cycle of sockeye salmon.

the KING SALMON *in Alaska*

Alaska Department of Fish and Game
Wildlife Notebook Series

THE KING SALMON *(Oncorhynchus tshawytscha)* is Alaska's state fish and is one of the most important sport and commercial fish native to the Pacific coast of North America. It is the largest of all Pacific salmon with weights of individual fish commonly exceeding 30 pounds. A 126-pound king salmon taken in a fish trap near Petersburg, Alaska in 1949 is the largest on record.

The king salmon has numerous local names. In Washington and Oregon, king salmon are called chinook, while in British Columbia they are called spring salmon. Other names are quinnat, tyee, tule and blackmouth.

RANGE: In North America, king salmon range from the Monterey Bay area of California to the Chukchi Sea area of Alaska. On the Asian coast, king salmon occur from the Anadyr River area of Siberia southward to Hokkaido, Japan.

In Alaska, it is abundant from the Southeastern panhandle to the Yukon River. Major populations return to the Yukon, Kuskokwim, Nushagak, Susitna, Kenai, Copper, Alsek, Taku and Stikine rivers. Important runs also occur in many smaller streams.

GENERAL DESCRIPTION: Adults are distinguished by the black irregular spotting on the back and dorsal fins and on both lobes of the caudal or tail fin. King salmon also have a black pigment along the gum line which gives them the name "blackmouth" in some areas.

In the ocean, the king salmon is a robust, deep-bodied fish with a bluish-green coloration on the back which fades to a silvery color on the sides and white on the belly. Colors of spawning king salmon in fresh water range from red to copper to almost black, depending on location and degree of maturation. Males are more deeply colored than the females and also are distinguished by their "ridgeback" condition and by their hooked nose or upper jaw. Juveniles in fresh water are recognized by well-developed parr marks which are bisected by the lateral line.

LIFE HISTORY: Like all species of Pacific salmon, king salmon are anadromous. They hatch in fresh water, spend part of their life in the ocean and then spawn in fresh water. All kings die after spawning.

King salmon may become sexually mature from their second through seventh year and as a result, fish in any spawning run may vary greatly in size. For example, a mature three-year-old will probably weigh less than four pounds, while a mature seven-year-old may exceed 50 pounds.

Females tend to be older than males at maturity. In many spawning runs, males outnumber females in all but the six- and seven-year age groups. Small kings that mature after spending only one winter in the ocean are commonly referred to as "jacks" and are usually males. Alaska streams normally receive a single run of king salmon in the period from May through July.

King salmon often make extensive freshwater spawning migrations to reach their home streams in some of the larger river systems. Yukon River spawners bound for the extreme headwaters in Yukon Territory, Canada, will travel more than 2,000 river miles during a 60-day period.

King salmon do not feed during the freshwater spawning migration so their condition deteriorates gradually during the spawning run as they utilize stored body materials for energy and for the development of reproductive products.

Each female deposits from 3,000 to 14,000 eggs in several gravel nests, or redds, which she excavates in relatively deep, moving water. In Alaska, the eggs usually hatch in late winter or early spring, depending on time of spawning and water temperature.

The newly hatched fish, called alevins, live in the gravel for several weeks until they gradually absorb the food in the attached yolk sac. These juveniles, called fry, wiggle up through the gravel by early spring.

In Alaska, most juvenile king salmon remain in fresh water until the following spring when they migrate to the ocean in their second year of life. These seaward migrants are called smolts.

Juvenile kings in fresh water first feed on plankton, then later eat insects. In the ocean, they eat a variety of organisms including herring, pilchard, sandlance, squid and crustaceans. Salmon grow rapidly in the ocean and often double their weight during a single summer season.

COMMERCIAL FISHERY: Worldwide king salmon catches during 1967-71 averaged slightly more than 3.5 million fish per year. The United States harvested approximately 52 per cent of these fish, while Canada took 33 per cent; Japan 12 per cent and Russia 3 per cent. Alaska's annual harvest during this period averaged about 639,000 fish per year, or about 21 per cent of the North American catch. The majority of the Alaska catch is made in the Southeastern, Bristol Bay and Arctic-Yukon-Kuskokwim areas. Fish taken commercially average about 18 pounds. The majority of the catch is made with troll gear and gill nets.

There is an excellent market for king salmon because of their large size and excellent table qualities. Recent catches in Alaska have had first wholesale pack values approaching $6 million and brought fishermen nearly $4 million per year.

SUBSISTENCE AND SPORT FISHERY: Catches by Eskimo and Indian subsistence fishermen in the Yukon and Kuskokwim rivers have averaged about 60,000 king salmon annually in recent years. The king salmon is perhaps the most highly prized sport fish in Alaska and is extensively fished by anglers in the Southeastern and Cook Inlet areas. Trolling with rigged herring is the favored method of angling in salt water while lures and salmon eggs are used by freshwater anglers. The sport fishing harvest of king salmon is over 26,000 annually with Cook Inlet and adjacent watersheds contributing over half of the catch.

Ron Regnart

Stan Kubik

Revised and reprinted 1978

Range of King Salmon in Alaska (shaded area)

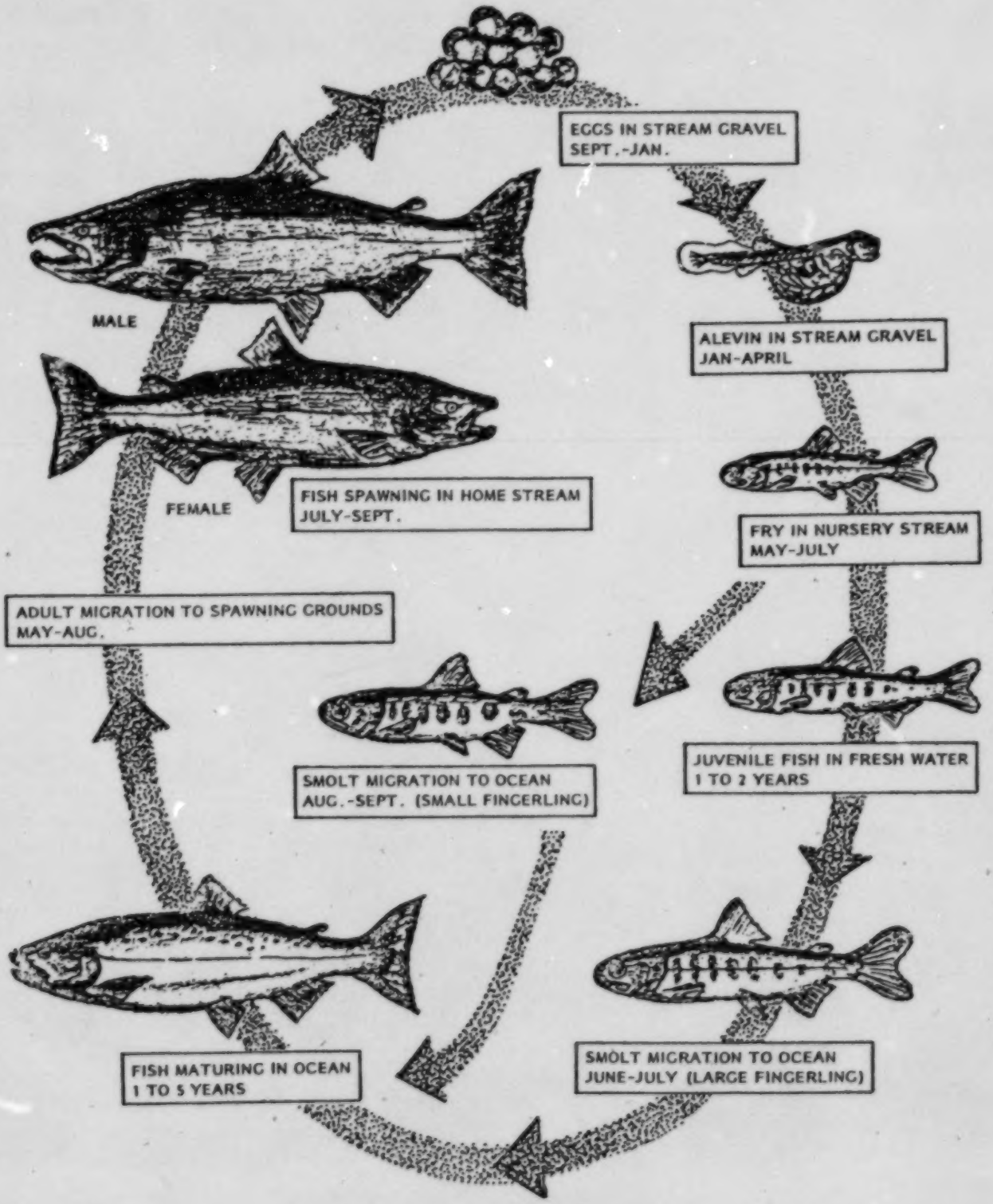
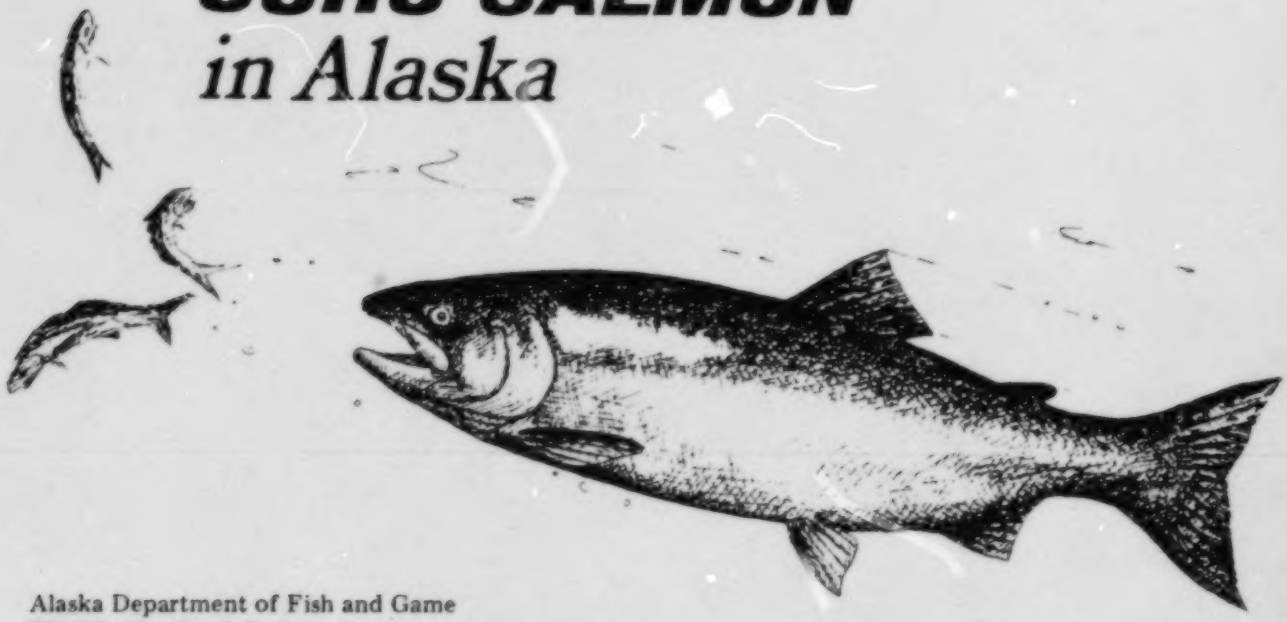


Figure 9.--Life cycle of chinook salmon.

the **COHO SALMON** *in Alaska*



Alaska Department of Fish and Game
Wildlife Notebook Series

COHO SALMON *(Oncorhynchus kisutch)* (Walbaum), are also called silver salmon in central and western areas of Alaska. This species of Pacific salmon is found in coastal waters of Alaska from Dixon Entrance in Southeastern to Point Hope on the Chukchi Sea. They also occur in the Yukon River to the Alaska-Yukon border.

Coho are characterized by being aggressive and highly adaptable. Juvenile forms are found in almost any type of rearing environment, and adults feed on a wide variety of food organisms and grow extremely rapidly during their 1½ years of ocean residency.

GENERAL DESCRIPTION: Adult coho are the second largest species of salmon, weights to 36 pounds and lengths to 35 inches. An average full-sized adult will usually be about 10 pounds and 29 inches long. Small dark spots are present on the back and usually on the upper lobe of the tail, but the spots and gums are not as darkly pigmented as in the chinook salmon. The "wrist" is unusually broad, and a silvery plate is evident on the tail. In stages of spawning coloration, both sexes turn dark with a maroon-reddish color on the sides, and the male develops a pronounced hooked snout with large teeth. Occasionally, precocious males return to spawn after only three to six months at sea. These small "jacks" resemble adults but have more rounded tail lobes. Juvenile coho have parr marks evenly distributed above and below the lateral line, with these parr marks narrower than the interspaces. No black spots are visible on the dorsal fin. The anal fin has a long leading edge usually tipped with white and all of the other fins are frequently tinged with orange.

LIFE HISTORY: Coho salmon enter spawning systems from August through November, usually during periods of peak high water. The adults school in pools, ponds or lakes for several weeks until ripe, then move into shallow tributaries with clean gravel riffle areas to spawn. Spawning frequently takes place at night. The female digs a depression by turning on her side and using rapid body and tail motion. The female protects her nest area, and males frequently chase and combat each other for occupancy of this same area. Spawning takes place when a male moves close beside the female, and body vibrations simultaneously induce egg deposition and sperm emission. Several nests and spawning acts occur until the female has deposited from 2,400 to 4,500 eggs. This spawning takes place in Alaska from late September through January, and spawned-out coho may be seen in some stream area as late as March.

The egg develops slowly during the cold winter months, hatches in early spring, and then the embryo remains in the gravel and utilizes the egg yolk material until emerging in May or June. The young fry school in shallow areas along the stream shoreline, but soon establish an individual territory which they defend from other juvenile coho with aggressive displays and "nipping." This territory is usually along the shoreline or behind a log or boulder where the young fish does not have to fight the current, but can dart out to feed on adult surface insects or drifting insect larvae which constitute its principal source of food. The juveniles will grow rapidly during the early summer months and find deeper pool areas or spring-fed side ponds to spend the winter. They will spend one, two or three winters in the stream before migrating to sea as a smolt in the early spring. Coho also frequently rear in ponds or lakes, where they feed along shoreline areas. Rearing may also occur in brackish-water lagoon areas.

Little is known of ocean life of coho salmon, although tagging in the Gulf of Alaska has indicated that a large number of Southeastern Alaska coho move north along the coastline until reaching the vicinity of Kodiak Island, where the Alaska Gyre is followed counter-clockwise until the return to the stream of origin.

COMMERCIAL FISHING: The commercial catch of coho salmon in Alaska is about two million fish per year. About one million of these are taken in Southeastern Alaska, with the catch nearly evenly divided between the troll and net fisheries. High quality troll-caught coho are now frequently frozen whole and shipped to European markets where they are smoked and sold as a delicacy. The net catches consist of seine-caught coho taken as they enter straits for inside waters, and catches from gill nets set near the mouths of major coho rivers.

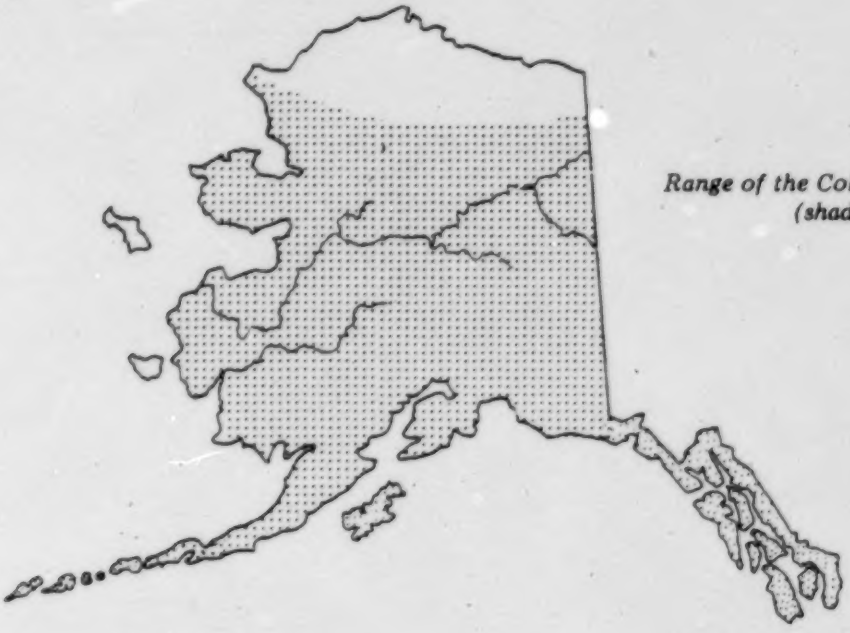
SPORT FISHING: The coho salmon is the major marine sport fish in the state and is available in coastal waters from July through September. They are readily taken by trolling or mooching with herring, streamer flies or a variety of lures. Coho are spectacular fighters and the most acrobatic of the Pacific salmon. They are also a popular stream fish, being accessible to most anglers from August through October, and readily take salmon egg clusters, spoons, spinners and streamer flies.

Coho have been stocked in a variety of land-locked lakes in the state and have resulted in good sport fisheries. They are able to more readily compete with stickleback populations which have proved to be such a nemesis to planted trout. Land-locked coho have been observed up to eight pounds in one Kenai Peninsula lake.

Richard A. Marriott

Sidney M. Logan

Reprinted 1978



Range of the Coho salmon in Alaska (shaded area)

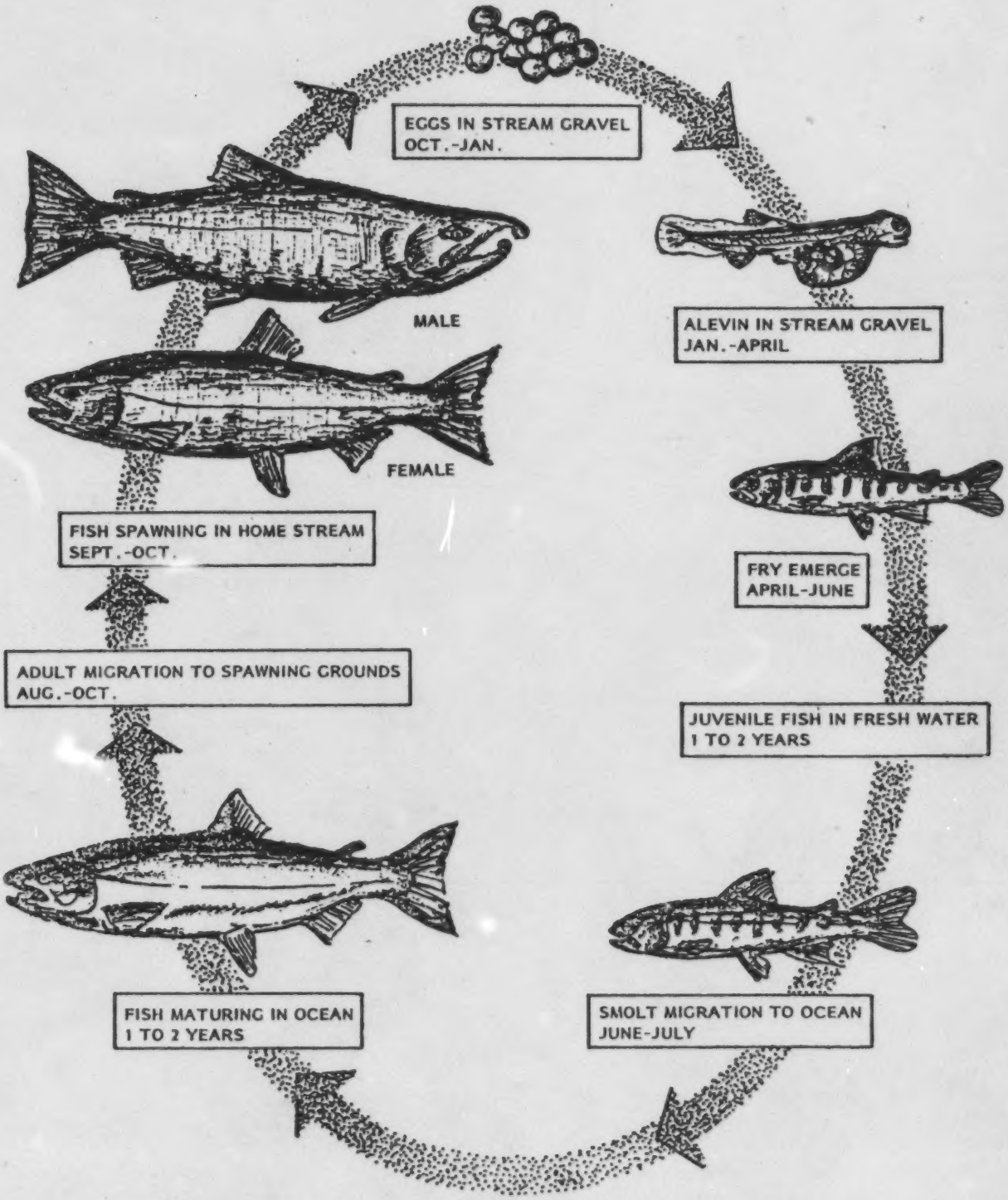
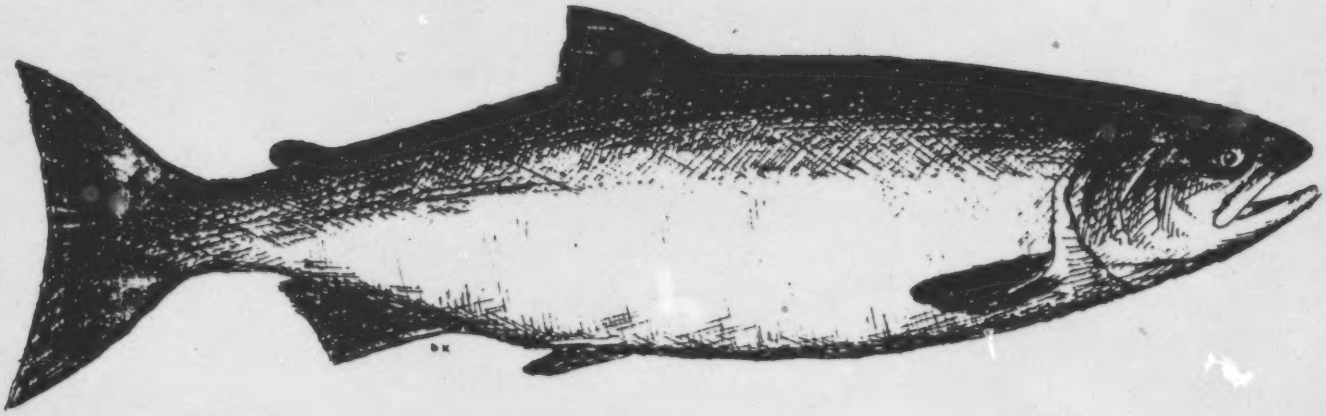


Figure 11.--Life cycle of coho salmon.

the **CHUM SALMON** *in Alaska*



Alaska Department of Fish and Game
Wildlife Notebook Series

CHUM SALMON, *(Oncorhynchus keta)*, have the widest distribution of any of the Pacific salmon. They range south to the Sacramento River in California and to the island of Kyushu in the Sea of Japan. In the north they range east in the Arctic Ocean to the Mackenzie River in Canada and west to the Lena River in the U.S.S.R. Chum salmon have been the least utilized of all Pacific salmon in Alaska until recent years, except in arctic and northwestern Alaska. There they are known as "dog salmon" and are a traditional source of dried fish for winter use.

GENERAL DESCRIPTION: Ocean fresh chum salmon are metallic greenish-blue on the dorsal surface (top) with medium-size black specklés. They are difficult to distinguish from sockeye and coho salmon at this time without examining their gills. Chum have fewer but larger gillrakers than other salmon. After nearing fresh water, however, the chum salmon changes color—particularly noticeable are vertical bars of green and purple, which give them the common name, "calico salmon." The males develop the typical hooked snout of Pacific salmon and very large teeth which partially account for their other name of "dog salmon." The females have a dark horizontal band along the lateral line; their green and purple vertical bars are not obvious.

LIFE HISTORY: Chum salmon often spawn in small side channels and other areas of large rivers where upwelling springs provide excellent conditions for egg survival. They also spawn in many of the same places as do pink salmon, i.e., small streams and intertidal zones. Some chum in the Yukon River travel over 2,000 miles to spawn in the Yukon Territory. These have the brightest color and possess the highest oil content of any chum salmon when they begin their upstream journey.

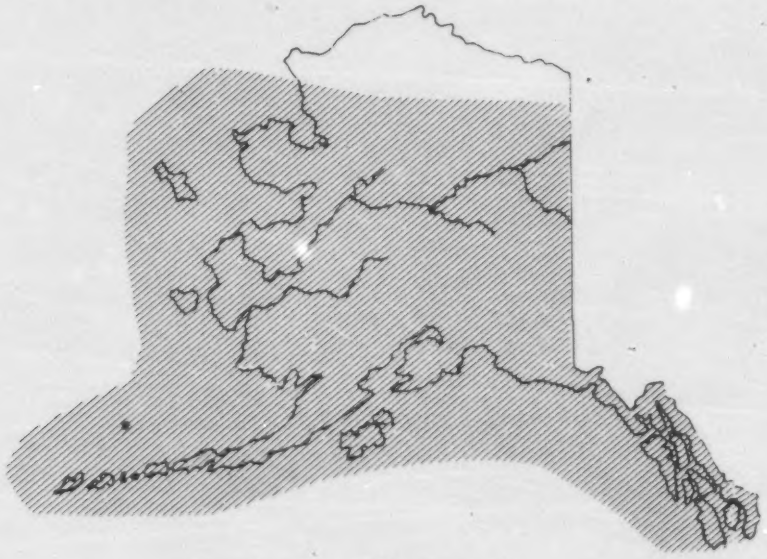
Chum salmon spawning is typical of Pacific salmon with the eggs deposited in redds located primarily in upwelling spring areas of streams. Female chum lay as many as 2,700 eggs. Chum do not have a period of freshwater residence after emergence of the fry as do chinook, coho and sockeye salmon. Chums are similar to pink salmon in this respect, except that chum fry do not move out into the ocean in the spring as quickly as pink fry. Chum fry feed on small insects in the stream and estuary before forming into schools in salt water where their diet usually consists of zooplankton. By fall they move out into the Gulf of Alaska, where they spend one or more of the winters of their three- to six-year lives. In southeastern Alaska most chum salmon mature at four years of age, although there is considerable variation in age at maturity

between streams; there is also a higher percentage of older chum in the northern areas of the State. Chum vary in size at maturity from four to over 30 pounds, but usually range from seven to 18 pounds, with females usually smaller than males.

SPORT FISHERY: Sport fishermen only occasionally hook chum salmon in either fresh or salt water, and usually as they are trolling for other Pacific salmon. After entering fresh water, chum are seldom highly palatable unless smoked. In the Yukon and other rivers in arctic Alaska, however, chum salmon remain an important year-round source of fresh and dried fish.

COMMERCIAL FISHERY: In the last few years an average of five million chum salmon, worth over $15 million, have been caught in Alaska. Most chum are caught by purse seines and drift gill nets, but fishwheels and set gill nets harvest a portion of the catch. Until recent years, chum were the least utilized of all the Pacific salmon as a commercial species. In many areas they have been harvested incidental to the catch of pink salmon. Scarcity of other Pacific salmon and the development of markets for fresh and frozen chum in Japan and northern Europe have increased their demand, especially in the last decade. The Alaska Department of Fish and Game has recently begun to build hatcheries primarily for chum salmon production.

James R. Dangel
Printed 1978



Range of Chum Salmon in Alaska (shaded area)

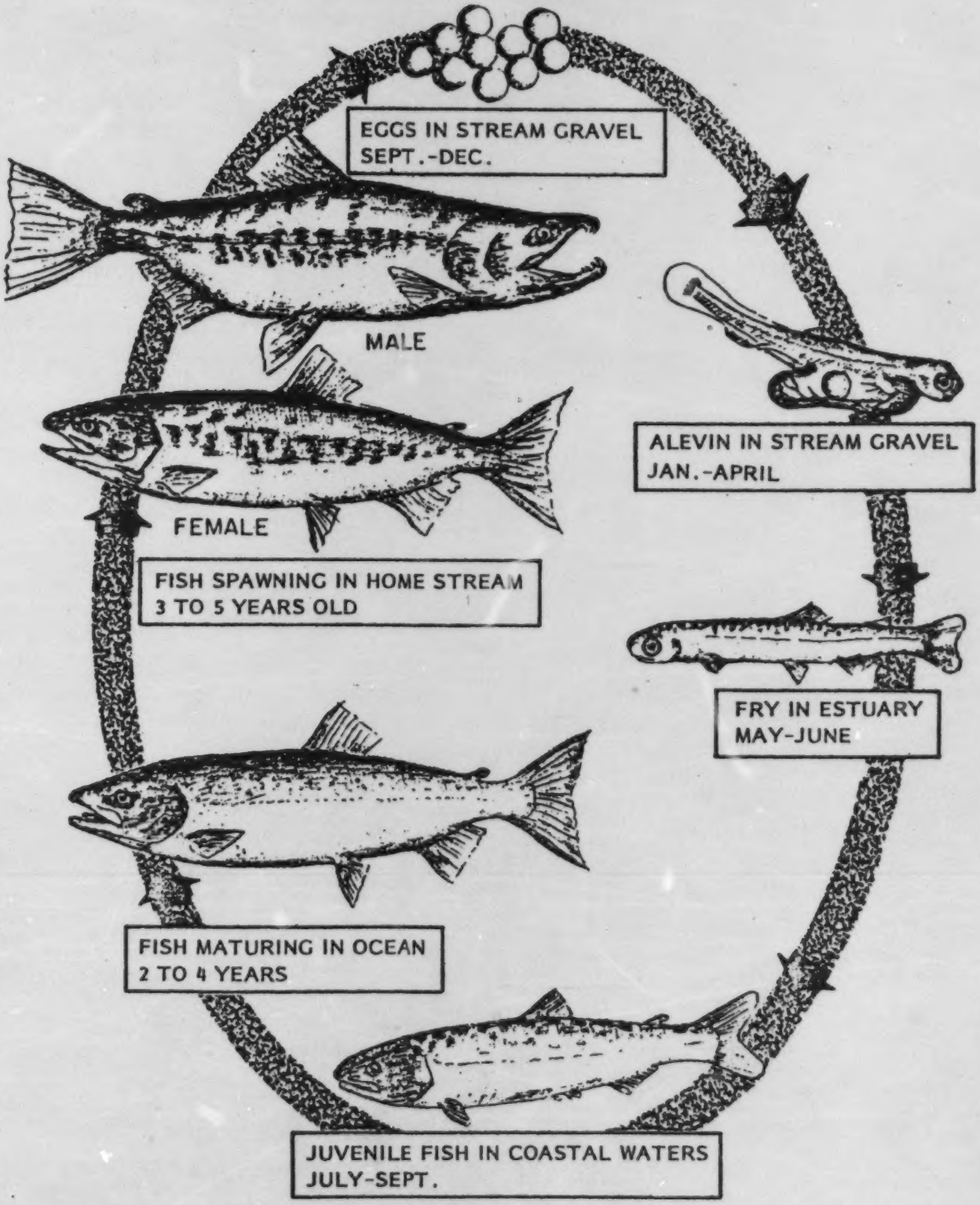
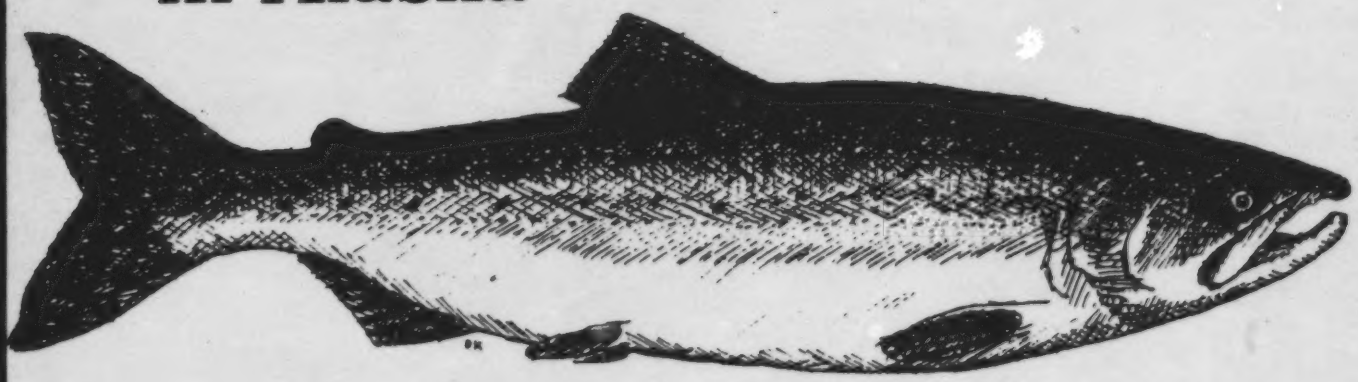


Figure 5.--Life cycle of chum salmon.

the **PINK SALMON** *in Alaska*



Alaska Department of Fish and Game
Wildlife Notebook Series

The PINK SALMON *(Oncorhynchus gorbuscha)* is also known as the "humpback" or "humpy" because of its very pronounced, laterally flattened hump which develops on the back of the adult male before spawning. It is called the "bread and butter" fish in many Alaskan coastal fishing communities because of its importance to commercial fisheries and thus to local economies. Pink salmon also contribute substantially to the catch of sport anglers and subsistence users in Alaska. It is native to Pacific and Arctic coastal waters in the east from northern California to the Mackenzie River, Canada, and in the west from the Lena River in Siberia to Korea.

GENERAL DESCRIPTION: The pink salmon is the smallest of the Pacific salmon found in North America with an average weight of about three and one-half or four pounds and average length of 20 to 25 inches. An adult fish returning to coastal waters is bright steely blue on top and silvery on the sides with many large black spots on the back and entire tail fin. Its scales are very small and the flesh is pink. As the fish approaches the spawning streams the bright appearance of the male is replaced by brown to black above with a white belly; females become olive green with dusky bars or patches above and a light-colored belly. By the time the male enters the spawning stream, it has developed the characteristic hump and hooked jaws. Juvenile pink salmon are entirely silvery, without the dark vertical bars, or parr marks, of the young of other salmon species.

LIFE HISTORY: Adult pink salmon enter Alaskan spawning streams between late June and mid-October. Different races or runs with differing spawning times frequently occur in adjacent streams or even within the same stream. Most pink salmon spawn within a few miles of the coast and spawning within the intertidal zone at the mouth of streams is very common. Shallow riffles where flowing water breaks over coarse gravel or cobble-size rock and the downstream ends of pools are favored spawning grounds. The female pink salmon carries 1,500 to 2,000 eggs depending on her size. She digs a nest or redd with her tail and releases the eggs into the nest. They are immediately fertilized by one or more males and then covered by further digging action of the female. The process is commonly repeated several times until all the female's eggs have been released. After spawning, both males and females soon die, usually within two weeks.

Sometimes during the winter, eggs hatch into alevins, or fry with yolk sacs attached. The alevins feed on the yolk material for continued growth, development and energy. In late winter or spring, just as the yolk material is becoming depleted, the alevins swim up out of the gravel and migrate downstream into salt water. The emergence and outmigration of fry is heaviest during hours of darkness and usually lasts for several weeks before all the fry have emerged.

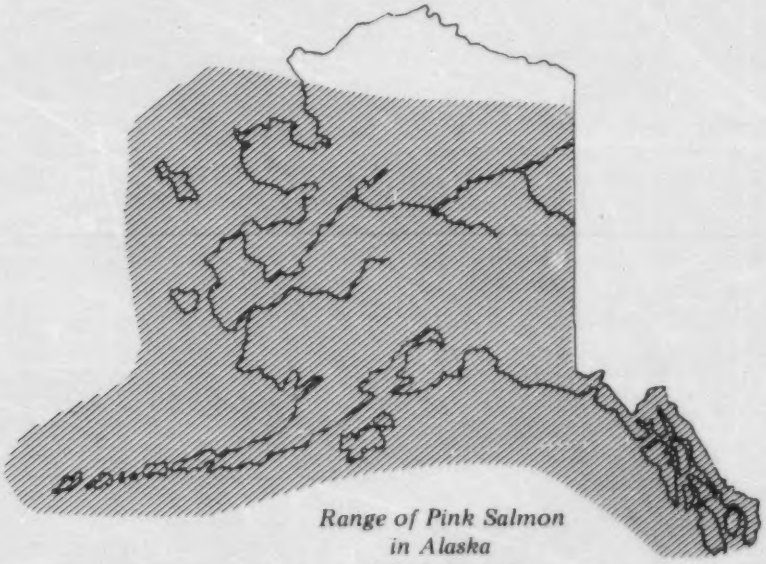
Following entry into salt water the juvenile pink salmon move along the beaches in dense schools near the surface, feeding on plankton, larval fishes and occasional insects. Predation is heavy on the very small, newly emerged fry, but growth is rapid. By the next fall, at an age of about one year, the juvenile pink salmon are four to six inches long and are moving into the ocean feeding grounds in the Gulf of Alaska and Aleutian Islands areas. High seas tag-and-recapture experiments have revealed that pink salmon originating from specific coastal areas have characteristic distributions at sea which are overlapping, nonrandom and nearly identical from year to year. The range of Alaskan pink salmon at sea overlaps that of pink salmon from Asia, British Columbia and Washington.

Pink salmon almost invariably mature in two years which means that odd-year and even-year populations are essentially unrelated. Frequently in a particular stream one cycle or the other (odd-year or even) will predominate although in some streams both odd- and even-year pink salmon are about equally abundant. Occasionally cycle dominance will shift and the previously weak cycle will become most abundant.

COMMERCIAL FISHING: In the early years fixed and floating fish traps were employed extensively to catch pink salmon; such traps were prohibited following 1959. Now most pink salmon are taken with purse seines and drift or set gill nets. Lesser numbers are taken with troll gear or beach seines. The average annual Alaska harvest since 1952 of 23.3 million pink salmon comprises about 67% of the total North American catch and about 21% of the total catch worldwide.

Pink salmon fisheries are important in all coastal regions of Alaska south of Kotzebue Sound. Commercial canning and salting of pink salmon began in the late 1800s and expanded steadily until about 1920. Runs declined markedly during the 1940s and 1950s; however, intensive effort is being made to rebuild and enhance those runs through hatcheries; fish ladders and improved regulatory management.

Alan Kingsbury
1978



Range of Pink Salmon in Alaska (shaded area)

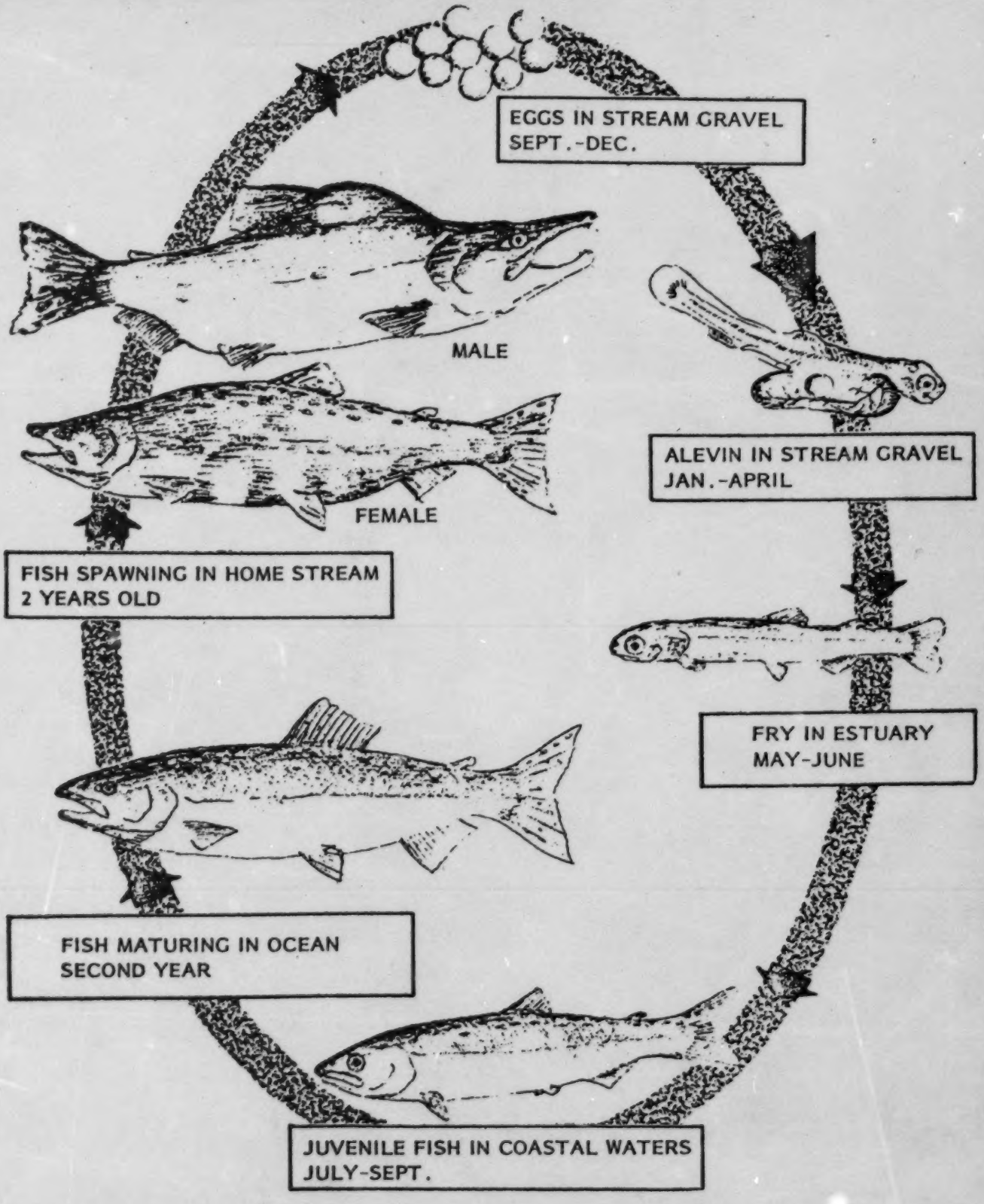


Figure 3.--Life cycle of pink salmon.

HALIBUT

The halibut is an interesting fish to study because of the metamorphosis (meta = change, morphe = form) it undergoes during the first six months of its life. The left eye migrates to the right side of the fish so both eyes are on "top". The coloring of the halibut (dark on top and light on the bottom) help the fish avoid being seem by prey or predators. Female halibut may live up to 40 years and weigh up to 500 pounds.

ACTIVITIES:

- Compare the life cycle of the halibut with that of the salmon. What are the major differences?

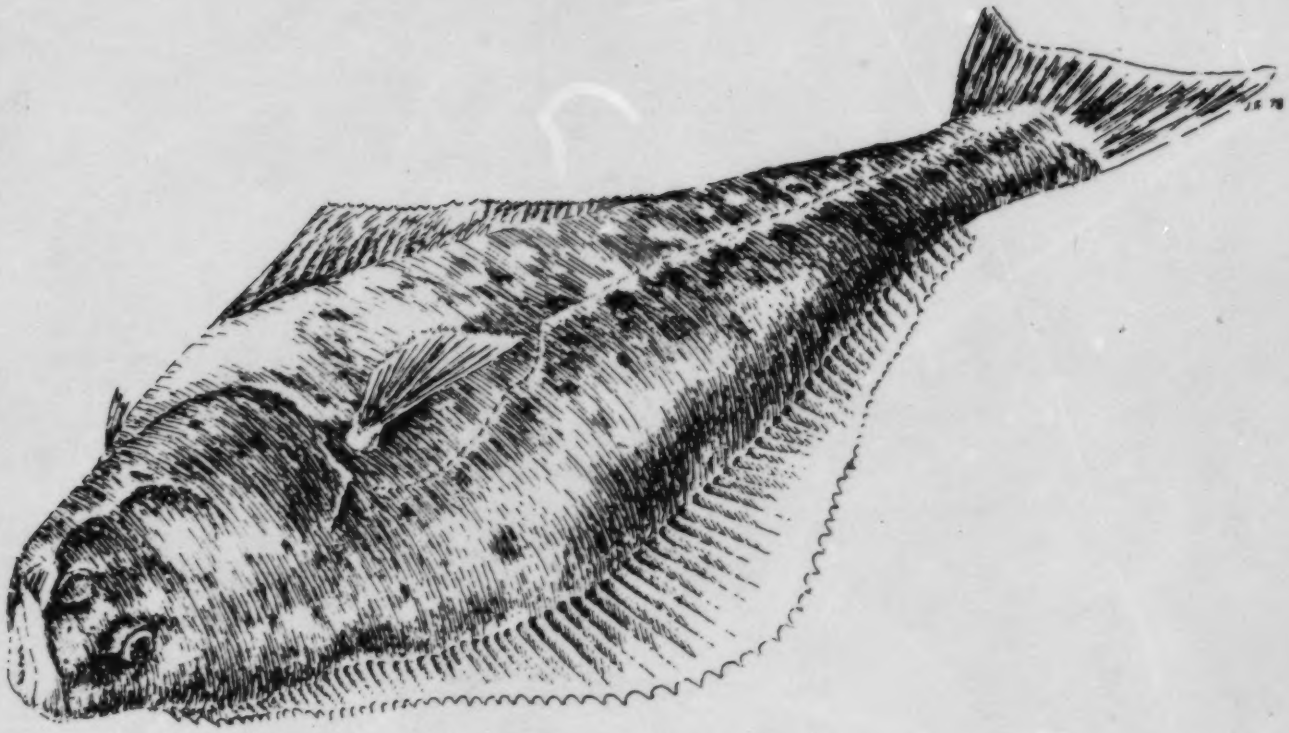
- The salmon and halibut eat different food. How is the body of each adapted for what it eats?

- Commercial halibut fishing is regulated by an international commission. Can the class think of reasons why this is so? (e.g. where do adult halibut live?)

- Develope a prey-predator game with the protective coloration.

- Make up a "yarn" about trying to land a 400 pound halibut.

the **PACIFIC HALIBUT** *in Alaska*



Alaska Department of Fish and Game
Wildlife Notebook Series

THE PACIFIC HALIBUT *(Hippoglossus stenolepis)* was called "halybutte" in Middle English, meaning the flatfish to be eaten on holy days.

GENERAL DESCRIPTION: Halibut are more elongated than most flatfishes, the width being about one-third the length. Small scales are embedded in the skin. Halibut have both eyes on their dark or upper side. The color on the dark side varies but tends to assume the coloration of the ocean bottom. The underside is lighter, appearing more like the sky from below. This color adaptation allows halibut to avoid detection by both prey and predator.

LIFE HISTORY: Spawning generally takes place from November to March. During spawning season mature males and females are found along the edge of the continental shelf. Males are sexually mature at seven or eight years while females may first become mature between the ages of eight and twelve. Each adult female lays two to three million eggs annually, depending on her size. The fertilized eggs hatch after fifteen days. Because eggs and hatched postlarvae are free-floating, they may be transported hundreds of miles.

During the six-month free-floating stage, many changes take place. One of the most noticeable is the migration of the left eye to the right side of the fish. During this time the halibut rise to the surface and are carried to shallower waters by the prevailing currents. Then juvenile halibut begin bottom life, feeding on shrimp and other small crustaceans. From one to three years the juveniles stay on the inshore grounds. At about five to seven years halibut move offshore.

Halibut live quite a long time, but their growth rate varies depending on locations and habitat conditions. Females grow faster than males and also live longer. The oldest recorded female was 42 years old and the oldest male was 27 years of age. Halibut are the largest of all flatfish. The largest ever recorded for the northern Pacific was a 495-pound fish caught near Petersburg, Alaska.

FOOD HABITS: Being strong swimmers, halibut are able to eat a large variety of fishes (cod, turbot, pollock) plus some invertebrates such as crab and shrimp. Sometimes halibut leave the ocean bottom to feed on pelagic fish like sandlance and herring.

FISHERIES: Halibut, along with salmon, provided subsistence for several Pacific Coast Native groups. Much folklore is found concerning the halibut. Each fishhook used by the Indians was carved with special designs to bring good luck and large fish. The halibut were smoked and dried for winter use.

Commercial fishing probably began in 1888 when three sailing ships from New England fished off the coast of Washington State. As the industry grew, company-owned steamers carrying several smaller fishing dories dominated the fishing.

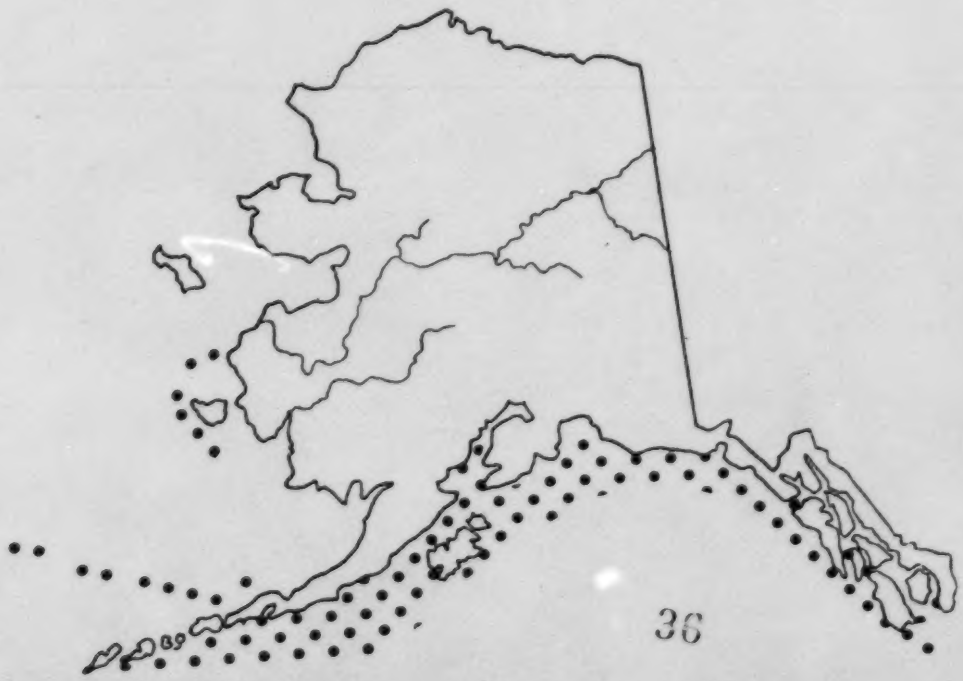
Today, most halibut fishing off Southeast Alaska and Canada is done in owner-operated boats. Gear consists of units called "skates" which are composed of five or six lines of groundline of fifty fathoms each. Loops of twine are attached at regular intervals to which "gangions" about five feet long are joined. Each "gangion" has a hook at the end. The hook is baited with fresh or frozen herring, octopus or other fresh fish. Depending on fishing ground, time of year and bait used, gear remains in the water from four to thirty hours before being checked. Halibut are cleaned as soon as they are brought aboard and then they are put on ice to keep them fresh.

Some halibut are caught while sport fishing. This is usually incidental to other fishing.

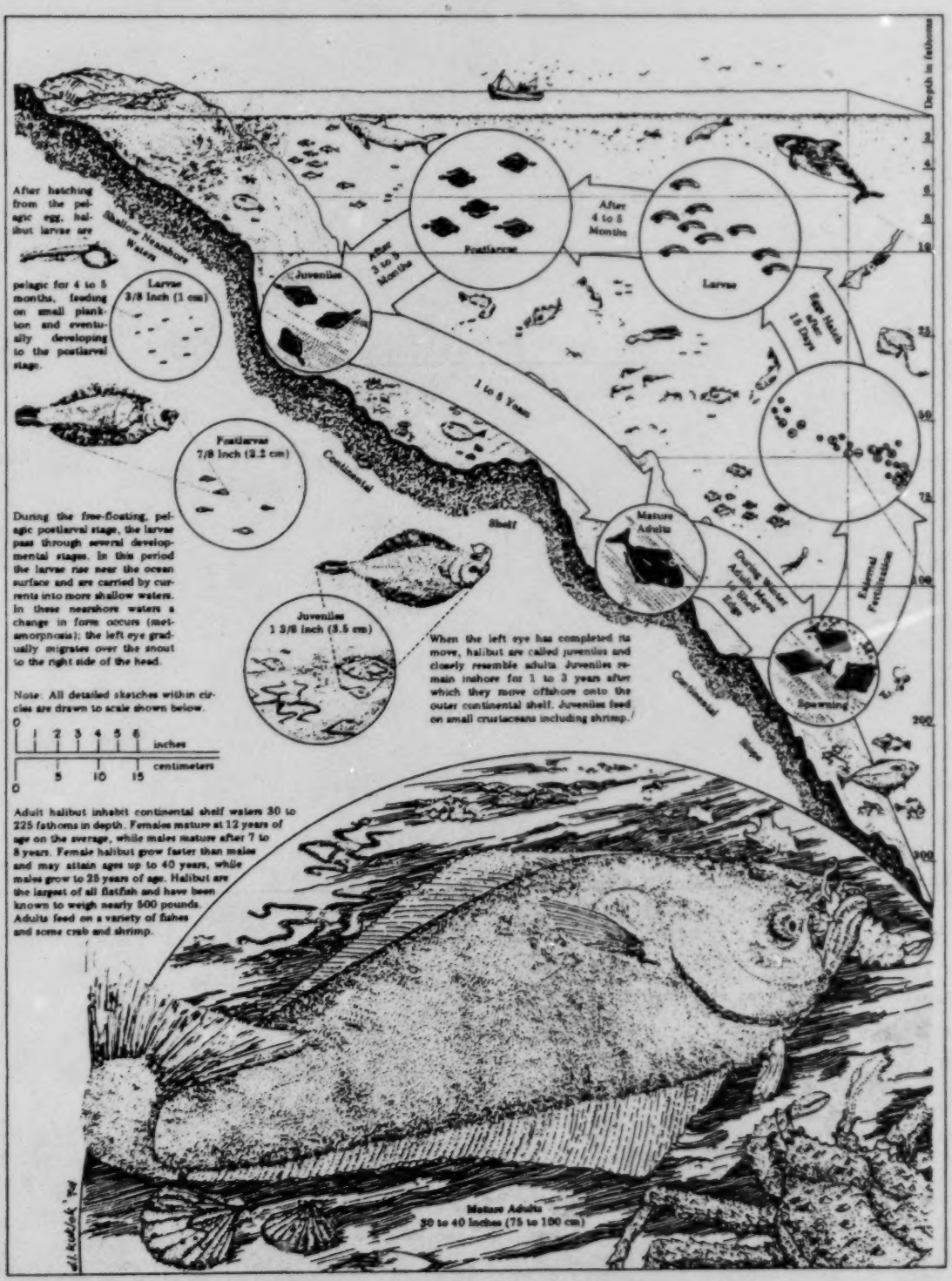
Fishing for Pacific halibut is regulated by the International Pacific Halibut Commission. Members from the United States and Canada meet yearly to review research, check the progress of the commercial fishery and make regulations for the next fishing season. The management of halibut fishing by this commission is intended to allow a maximum sustained yield of halibut

Tamara Smid
1978

Range of Pacific Halibut
in Alaska
(shaded area)



Life Cycles of Selected Marine Animals


After hatching from the pelagic egg, halibut larvae are pelagic for 4 to 5 months, feeding on small plankton and eventually developing to the postlarval stage.
Larvae 3/8 inch (1 cm)
Postlarvae 7/8 inch (2.2 cm)
During the free-floating, pelagic postlarval stage, the larvae pass through several developmental stages. In this period the larvae rise near the ocean surface and are carried by currents into more shallow waters. In these nearshore waters a change in form occurs (metamorphosis); the left eye gradually migrates over the snout to the right side of the head.
Note: All detailed sketches within circles are drawn to scale shown below.
inches
centimeters
Juveniles 1 3/8 inch (3.5 cm)
When the left eye has completed its move, halibut are called juveniles and closely resemble adults. Juveniles remain inshore for 1 to 3 years after which they move offshore onto the outer continental shelf. Juveniles feed on small crustaceans including shrimp.
Adult halibut inhabit continental shelf waters 30 to 225 fathoms in depth. Females mature at 12 years of age on the average, while males mature after 7 to 8 years. Female halibut grow faster than males and may attain ages up to 40 years, while males grow to 28 years of age. Halibut are the largest of all flatfish and have been known to weigh nearly 500 pounds. Adults feed on a variety of fishes and some crab and shrimp.
After 4 to 5 Months
After 3 to 5 Months
Juveniles
Postlarvae
Larvae
Eggs Hatch after 15 Days
1 to 3 Years
Continental Shelf
Mature Adults
Spawning
Depth in fathoms
Mature Adults 30 to 40 Inches (75 to 100 cm)

The focus on salmon fishing in the Ketchikan area has perhaps obscured the potential of other marine resources.

DOLLY VARDEN

The young sea-run Dolly Varden occupies a similar habitat as the young Coho salmon but, with some important differences. Read the WNS on the Dolly Varden and review the Coho. These are the two species you will work with on the field trip. Note: the Dolly Varden will also return to spawn in the stream it was born. The fish does not necessarily die after releasing its eggs or sperm but may live to spawn again.

ACTIVITIES:

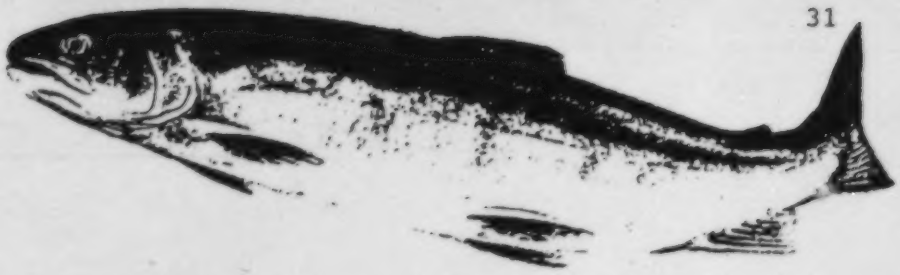
- Decide on four basic differences between the Dolly and Coho (e.g. surface feeding vs. bottom feeding) and design a pack of 52 cards repeating these characteristics equally. Decide on rules so each student must get all four characteristics to make up a fish and win a point. This could be expanded for all the fish species read about here.

- Using the WNS for reference, draw the life cycle for the Dolly Varden, along the same lines as those for the salmon and halibut.

- Find out the story behind the names of the Dolly Varden.

- Draw a cross-section of a stream where both Dolly Varden and Coho salmon live.

the sea-run



DOLLY VARDEN in Alaska

Alaska Department of Fish and Game
Wildlife Notebook Series

DOLLY VARDEN *(Salvelinus malma) (Walbaum)* are abundant in most coastal waters of Alaska from lower Southeastern to the tip of the Aleutian Chain and into the Bristol Bay area. Over most of this range, both anadromous *(sea-run)* and nonmigratory populations occur. Most of our information on the life history of Dolly Varden is on the sea-run variety. Little is known of the habits of Alaskan nonmigratory Dolly Varden.

GENERAL DESCRIPTION: Young Dolly Varden have about eight to 10 wide dark parr marks or oval blotches which contrast with the mottled olive-brown color of their body. The sea-run fish are silvery with an olive-green to brown color on the dorsal surface and numerous red to orange spots on their sides. The mature males become brilliant red on the lower body surface, and the lower fins become reddish black with white along the leading edges. Mature females are similar but are less brightly colored. Males develop an extended lower jaw which hooks upward, fitting into a groove which is formed in the upper jaw. A hook also forms in the females, but is considerably less developed.

Dolly Varden belong to a group of fish called chars. The light spots on their sides distinguish them from most trout and salmon which are usually black spotted or speckled.

LIFE HISTORY: Dolly Varden spawn in streams, usually during the fall in October and November. The female, depending on her size, may deposit from 600 to 6,000 eggs in depressions or redds which she constructs in the streambed gravel by digging with her tail fin. The male usually takes no part in these nest-building activities and spends most of his time fighting and chasing other males. When the female is ready to deposit her eggs, the male moves to her side and spawning begins. Sperm and eggs are released simultaneously into the redd.

The eggs develop slowly in the cold water temperatures usually present during the incubation period. Hatching of the eggs may occur in March, four to five months after fertilization. After hatching, the young Dolly Varden obtain food from their yolk sac and usually do not emerge from the gravel until this food source is used. Emergence usually occurs in April or May.

The young Dolly Varden rear in streams before beginning their first migration to sea. During this rearing period, their growth is slow, a fact which may be attributed to their somewhat inactive habits. Young Dolly Varden often remain on the bottom, hidden from view under stones and logs or in undercut areas along the stream bank. These habits are different from those of the more aggressive coho salmon young which often frequent the same habitat. Coho young are usually seen swimming and feeding near the water surface while the Dolly Varden young seldom swim and appear to select most of their food from the stream bottom.

Dolly Varden migrate to sea in their third or fourth year. At this time they are about five inches long and are called smolts. This migration usually occurs in May or June, although significant but smaller numbers

have been recorded migrating to sea in September and October. Once at sea, they begin a fascinating pattern of migration.

After their first seaward migration, Dolly Varden usually spend the rest of their life wintering in and migrating to and from lakes. Those hatched and reared in a lake system carry on annual feeding migrations to sea, returning to the lake each year for the winter. However, Dolly Varden originating from nonlake systems must seek a lake in which to winter. Recent research indicates that they find lakes by random searching, migrating from one stream system to another until they find one with a lake. Once a lake is found, these fish may also conduct annual seaward migrations in the spring, sometimes entering other stream systems in their search for food.

At maturity, Dolly Varden return to spawn in the stream from which they originated. The fish possess the ability to find their "home" stream without randomly searching as was the case in their original search for a lake. Those that survive the rigors of spawning return to the lake shortly thereafter.

Most Dolly Varden reach maturity at age five and six. At this age, they may be 12 to 16 inches long and may weigh from 0.5 to 1 pound. Mortality after spawning varies, depending on the sex and age of the Dolly Varden. Males suffer a much higher mortality after spawning, partly due to the fighting and the subsequent damage inflicted to each other. It is doubtful that much more than 50 per cent of the Dolly Varden live to spawn a second time. A small number live to spawn more than twice. Few Dolly Varden appear to live longer than eight years. Maximum size for most Dolly Varden is between 15 and 22 inches and from 1 to 3 pounds. However, occasional 9 to 12 pound lunkers are reported.

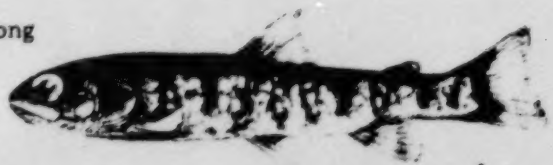
SPORT FISHING: Dolly Varden are one of Alaska's most important and sought-after sport fish. The fish is unique as it is the only member of the family *Salmonidae*, excluding salmon, that has readily adapted to the numerous small-to-medium size nonlake streams that enter our saltwater areas. Its importance and popularity can only increase as our population increases and further restrictions are placed on heavily utilized salmon streams.

To fish successfully for sea-run Dolly Varden in Alaska one should have a knowledge of their migratory habits. Since the Dolly Varden migrate to sea from lakes in the spring, a lake outlet stream, stream mouth or associated beach should be good from April through June. Good Dolly Varden fishing can be found in saltwater during May, June and July. As the mature fish return to their home stream to spawn and feed in August and September, most coastal streams in Southeastern Alaska and up through the Aleutian Chain provide good fishing for Dolly Varden. Try fishing near spawning salmon, in deep holes and at the creek mouth on an incoming tide. Lake fishing for sea-run Dolly Varden can be good from late August through November. The fish begin entering lakes in late August and are in prime condition after their spring and summer growing season. Ice fishing in lakes during the winter can also provide excellent sport for those willing to brave the elements.

Like its close relative, the Eastern brook trout, the Dolly Varden is excellent for eating. Catch one which has been at sea for awhile and you have a fish unsurpassed in quality. The flesh is pink, firm and full of flavor. For variety, try smoking some of your catch or cooking them in the hot coals of a beach fire wrapped in foil with a little butter, salt, pepper and lemon juice added.

Dolly Varden will usually strike readily at almost anything the angler offers. During the spring, try small spinning lures in the lake outlet streams and in saltwater. Streamer flies, resembling small fish, can produce surprising results along the saltwater beaches during the spring and summer months. Coastal streams in August and September can produce excellent fishing for those using spinning lures or a single salmon egg bounced along the bottom. Occasionally flies, both wet and dry, can be successfully used in both streams and lakes. A sea-run Dolly Varden caught on light spinning tackle or fly rod will produce a fight not easily forgotten.

Robert H. Armstrong
Revised and
reprinted 1978



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PRE-MIGRATORY YOUNG

HATCHERIES

I'm sure you'll find it enlightening to compare the number of hatcheries and other fish rearing facilities in Oregon or Washington and the facilities here in Alaska. Hatcheries are relatively new to our State even though commercial fisheries, canneries, salteries and the like are fairly longstanding.

The map on the next page shows the locations of hatcheries and rearing areas operational, under construction or proposed.
(Please note the legend.)

In Alaska, species being incubated or reared are predominantly Salmon with some Steelhead. Experiments are being done to see if Sheefish (a freshwater fish) can be incubated.

ACTIVITIES:

- Besides those facilities run by the Department of Fish and Game, there are some private hatcheries as well. Native corporations, colleges and, in some cases, individuals have begun to raise fish with state supervision. In Juneau, the Macaullays have a pink salmon facility at Kowee Creek. It is run by a private, non-profit corporation made up of several people, including the Macaullays. They are quite amenable to your visits. Give them a call to arrange a visit.

- Map all the private salmon facilities in Alaska. (The Department of Fish and Game will have this information.)

- Have students research and make a visual display of some corporations involved in fish rearing.

- Invite a knowledgeable person (lawyer, aquaculture program director...) to explain a non-profit corporation to your class. Perhaps the students could go through the process of creating their own mock corporation.

■ - rearing areas
● - operating or being developed
▲ - proposed sites
1 - king/coho facilities
2 - sockeye facilities
3 - pink/chum facilities
4 - trout facilities

HISTORY

These activities fit into any area of the curriculum.

ACTIVITIES:

- Act out a Tlinget legend.
- Explain the "morals" of each legend studied.
- After reading many Tlinget stories, discuss the Tlinget ideas about salmon migration out to sea and back again.

(The legend of Raven and the Fog Woman is a good one for some of your activities. It is summarized below.)

Raven wanted to get married. He went to a chief who was glad to give his youngest daughter as Raven's wife if he promised to treat her with respect. Raven agreed and soon the couple was married.

They lived contentedly all summer and fall. Then winter came and they were out of food. After many days without much food, Raven's wife began making a basket. Raven was a bit upset at this as they had nothing to put in the basket. That morning Raven saw salmon in the basket. Those were the first ones ever created.

Raven and his wife lived happily for a while as she created fish in the basket each morning. Soon Raven forgot that he owed this good fortune to his wife. He began to quarrel with her. He had forgotten also his promise to his father-in-law.

Soon Raven's wife left him. The chief was angry and vowed that since Raven had mistreated his daughter, Raven could not have her as a wife any longer.

(Taken from Alaska Multimedia Education Program booklet.)

(History activities, cont.)

- Make a display of Indian designs related to fish and fishing. A visit to the Alaska State museum will provide a wealth of design ideas, plus there is an exhibit of Native fishing gear.

- Make a halibut hook.

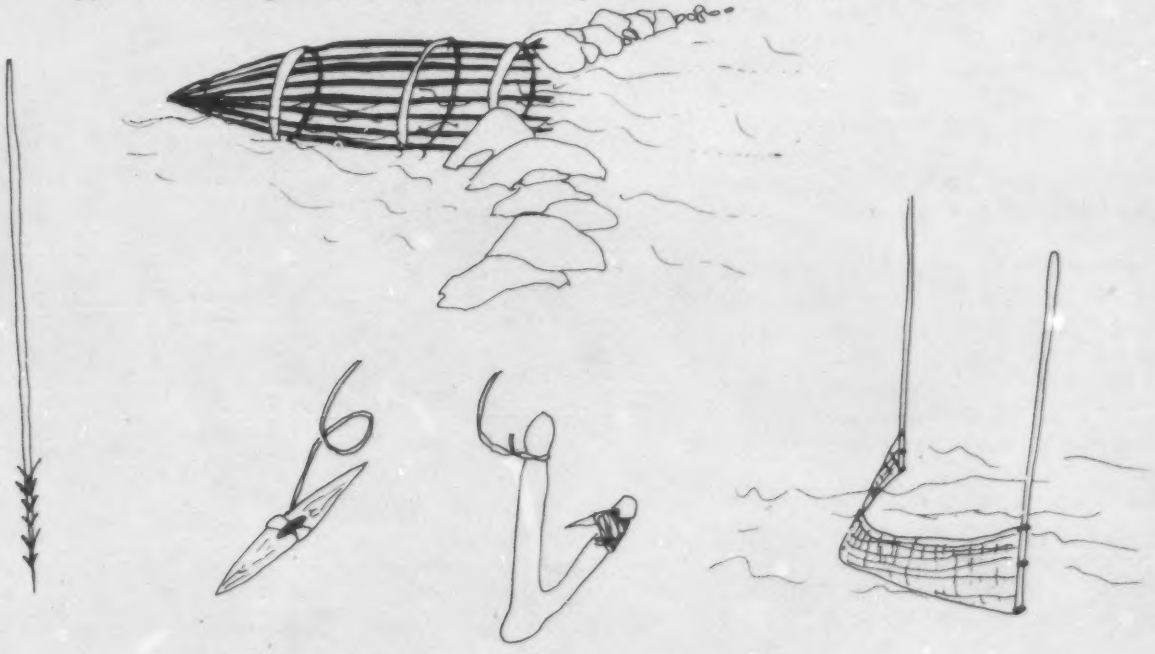
- Learn some songs about fishing. Some are found in Wanda Whitman's Songs that Changed the World.

- Students could report on the history of fishing in the United States.

- Students could interview a person about their fishing experiences. Some interesting interviews regarding fishing and other topics of interest to Native people are found in Kil-Kaas-Git. This is a quarterly publication put out by students at Prince of Wales High School. Copies are found in the state library.

- KTOO Radio (Juneau) has produced a series of eight programs narrated by old fishermen. Contact them about the possiblity of borrowing them for class.

- Students might make a display of early fishing techniques. For background, you might divide the class into groups with each group studying a specific type of fishing. Some of these early techniques are illustrated below.



Don't forget that before any of these techniques were used, people were probably pretty good at catching fish by hand!

FISH AS FOOD

Fish in the Southeast, besides being varied, abundant and tasty, are an excellent source of protein. They are important to your body for tissue growth and repair. For much of Alaska's Native population, fish was the mainstay of their diet.

About this time of year many people clean out their freezers to make room for the fresh fish they plan on catching soon. They would probably be happy to donate some for your cooking projects.

ACTIVITIES:

- Build a small scale smoke house.

- Have a parent help you smoke some fish. Make sure to allow a day or two for this. The University Extension Service has recipes if you want some.

- Pickle some herring or salmon. This will require more than a day or two as most pickled things need to set a few days before they're good.

- Use jars and cans to go through the process of canning some fish. Discuss why foods need to be pressurized and handled with care.

- Find out the nutritional content of various kinds of fish and other seafoods.

- Have a food feast with small groups making special dishes to be tried by the rest of the class. This could be done school-wide as well. You might delve into a bit of social studies by having the kids learn ways other cultures prepare fish dishes. Be sure to include a presentation by all cultures represented in your class, (Norwegian, Filipino, Tlingit, Japanese, Californian). I'm sure you could get parents to help.

- For math, have the kids convert a recipe for four people into a recipe serving twelve.

(Fish as Food, cont.)

CANNERIES, SALTERIES AND COLD STORAGE OPERATIONS

Processing of Alaskan salmon for market was probably begun by the Russian America Company before the United States owned the territory. A few barrels of salted salmon were shipped to California and St. Petersburg.

There was a saltery at Klawock, Alaska (on Prince of Wales Island) and 1878 the first salmon cannery was built there. Several others were built in Southeast within the span of a few years. The Nushagak River was the sight of the first cannery in the western part of the state. It opened in 1884. 1882 was the date of the opening of the first cannery in Central Alaska.

Over the years, more than two hundred canneries were built. Of those about one third were burned and not rebuilt. Most canneries have changed hands at least once; many were consolidated into larger companies like the Alaska Packers Company. The canneries were booming for years, yet recently some have been forced to close as fishing became more regulated and canning became more efficient.

Other interesting facts:

The first commercial plant for herring was a reduction plant (making oil and meal) on Admiralty Island which began operations in 1882.

The crab canning industry began in 1916 and the shrimp were first canned in Alaska around 1923.

There was a fish processing company called the Alaska Fish and Lumber Company.

Auke Bay Salmon Canning Company opened in 1916.

Klawock's cannery was made into a co-op years ago. Each Klawock Native is a partner.

ACTIVITIES:

- This could lead into several nice social studies and history projects.

- Students could write a history of one type of processing method in Alaska.

- Student might research a cannery that was operating during their grandparents' time. Then they could present a skit about cannery workers.

- Canneries could be mapped with students providing special legend symbols for crab, shrimp, salmon canneries.

- Perhaps students could find someone who knew about the Auke Bay Salmon Company. They could interview them with tape recorder and write up an article for newspapers, etc.

- Students might build a display showing the process of canning a salmon.

COMMERCIAL FISHING

Fishing techniques have become more complicated than the simple spearing or fish trap methods of previous generations of Alaskans. People still use the basic hooks, lines and nets, but more technology has been added.

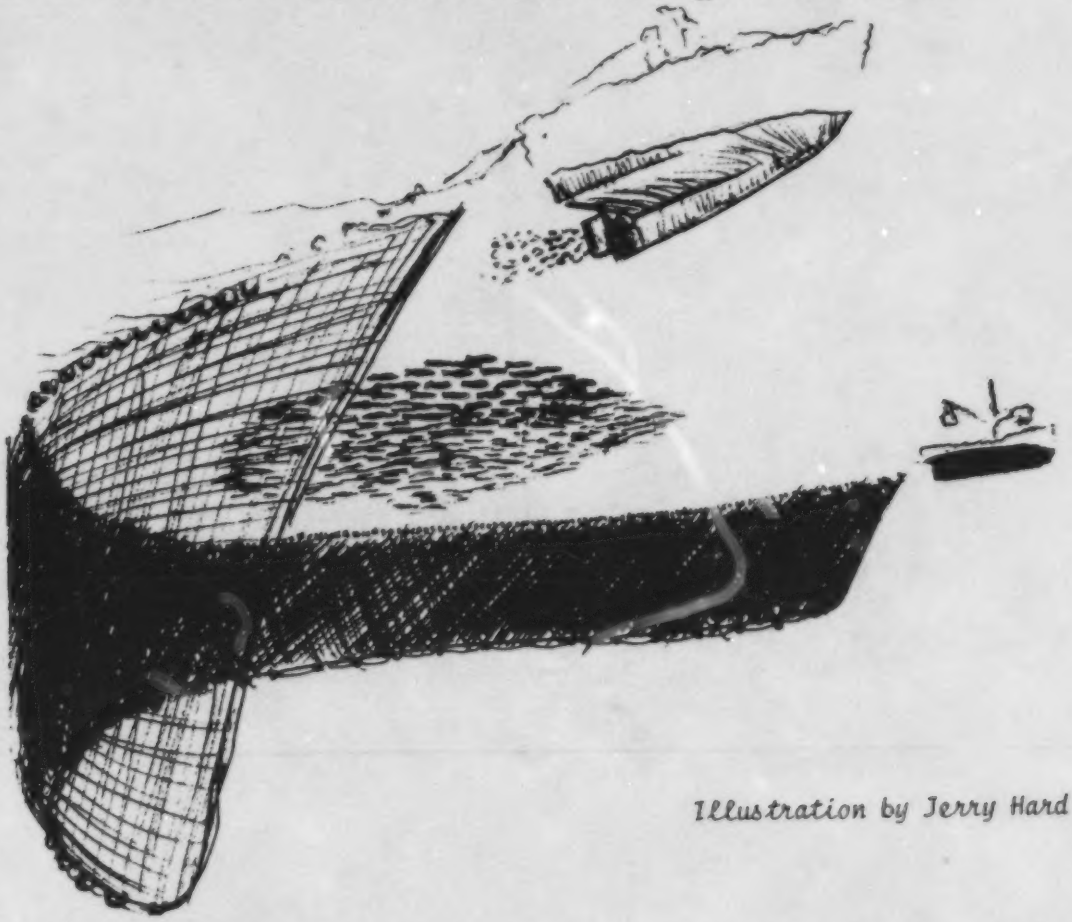


Illustration by Jerry Hard

SEINING- One of the most common means of catching quantities of fish (like herring and some salmon species) is the purse seine. The seine is a net (called a web) with weights (or leads) on the bottom and floats (corks) on top.

When seining, one end of the net is towed by a smaller boat or skiff from the stationary seine boat. The skiff pulls the net to surround a certain area where schools of fish are located. The skiff makes a large circle returning to the larger boat. Then that end of the net is attached to a winch and the bottom of the net is pulled tight to form a "purse". Then it is hauled slowly into the boat. Fish are collected and dropped into the storage area called the hold.

Seining involves the work of several people. One person is needed to run the skiff. Each part of the net - leads, web and cork - needs to be piled in an orderly fashion to insure that the net is not tangled for the next set. Generally, there is at least one more person who operates the power for hauling in the seine.

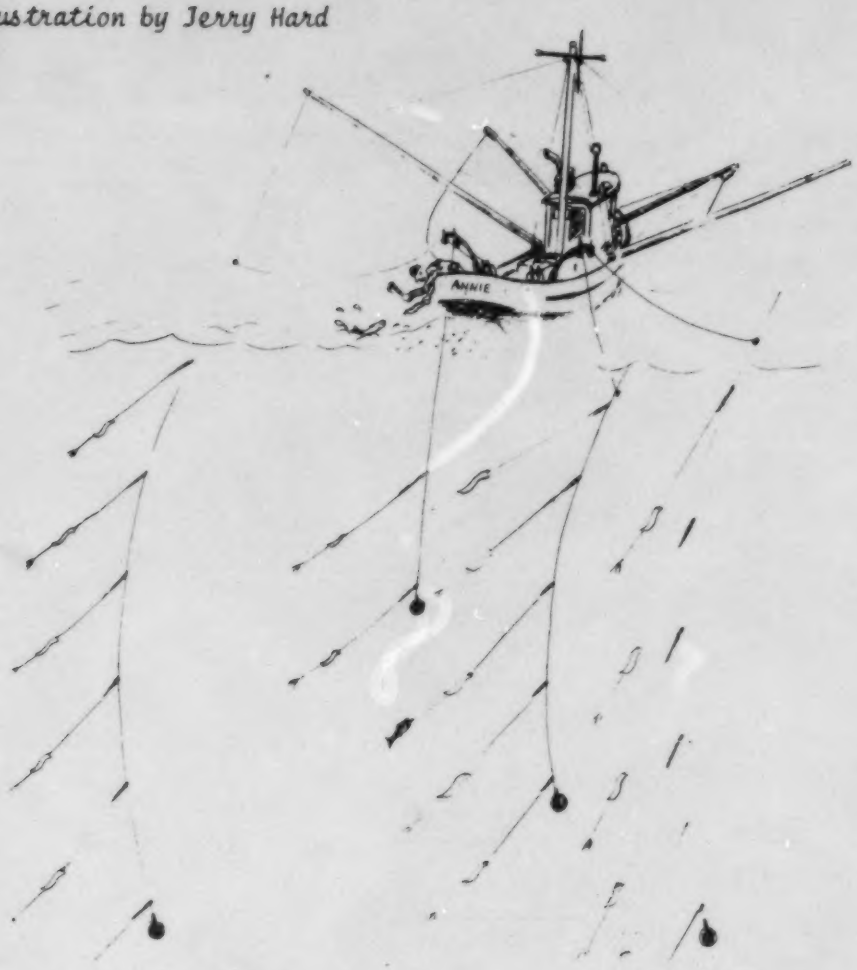
Illustration by Jerry Hard

GILL NETTING - Gill nets may be operated by fewer people than seine nets. Some fishermen using gill nets work in pairs or alone on a boat.

Gill nets are nets used to entangle the fish in the mesh as the nets are set in the paths of fish movement. These nets are generally 20 to 30 m (60 to 90 feet) long and 2 to 15 m (6 to 45 feet) deep. They are divided into two types depending on use. These two types are drift nets and set nets. Set nets are staked to fixed anchors along fish migration routes. Drift nets are free floating nets that entangle fish migrating in the path of the net.

The size of the net's mesh depends on the size of the fish to be caught.

Illustration by Jerry Hard



TROLLING is the only major method of catching salmon that does not utilize a net to capture the fish (other major methods are seining and gill netting). Trolling involves using hook and line and is basically an expansion of the standard sport fisherman's technique for catching salmon. The boats are generally equipped with two or four long poles. These are like fishing poles except that each one has several sets of hooks and lines. Herring is usually teamed with a "flasher" to attract salmon and the boat moves slowly enough to simulate the "live herring."

Ordinarily, less than ten per cent of the total salmon catch in Southeast Alaska (the only area in Alaska where it is legal) is caught by trollers. King and coho are the primary species caught.

Trollers are far more independent and less restricted than other fishermen. They work both "inside" and "outside" waters depending on the location of the best fishing spots. Also, trollers do not operate under weekly fishing periods like purse seiners and gill netters.

ACTIVITIES:

- Students might research the debate over power and hand trolling.

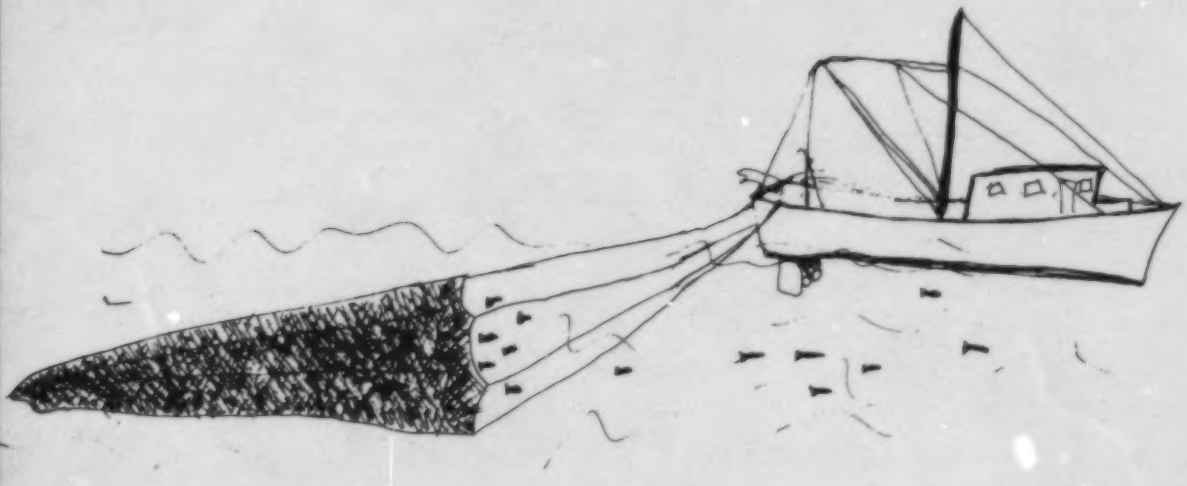
- Students can interview a troller concerning the limited entry issue.

SKATES - Sets of hooks and lines used to catch halibut (if they're set on the bottom) are called skates. Each skate consists of floats that mark the skate and anchors holding the 30 m (100 feet of) line in place. Spaced along the line are weighted lines and hooks baited with herring, other fish and sometimes octopus. Each halibut fisherman has several skates which he or she sets and checks periodically. The halibut fisherman must take care to check the skates frequently as the meat deteriorates and is sometimes eaten by sand fleas if it remains in the ocean too long.

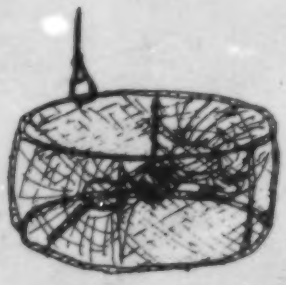
Illustration by Jerry Hard

TRAWLING - This is another method of fishing utilizing a net. The trawling net is a bag-like web that is towed along the ocean bottom trapping cod, snapper and other bottom-dwelling fish or shrimp. The open end of the net has supports so that the net remains open at all times. Actually you might think of a trawling net as a big mouth wide open. Periodically the net is hauled aboard and the fish or shrimp are placed in the hold of the boat.

Needless to say, fishermen using nets catch a variety of sea life besides the fish or shrimp they want. They may have to deal with jellyfish and starfish that get entangled in the net, too. This is more than just a nuisance because some people are extremely allergic to jellyfish stings. However, the quantities of fish caught usually compensate for this inconvenience.



POTS - King, Tanner and Dungeness crabs and shrimp provide profitable fisheries and are often caught using baited pots. These pots are usually made of wire mesh or filament nets around a circular or square frame. One or two openings or "doors" open inwards so the crustaceans can enter but not exit. Like the halibut skates, these pots are set and checked periodically.



SEASONS AND REGULATIONS

The Board of Fisheries - a group of interested and knowledgeable Alaskans appointed to four year terms by the governor - set seasons and regulations for all types of fishing. Generally, these are rules recommended by the Alaska Department of Fish and Game and/or the public. Seasons and regulations set by the Board are supposed to insure a sustained yield of these fishery resources.

At times there is a lot of controversy regarding fishing rules. A good example of this is the recent Hand Troll decision which was prefaced by many public meetings and much discussion.

The Department of Public Safety makes certain that seasons and regulations are kept. Someone in the class may have talked to one of their Fish and Wildlife Protection Officer and had their license checked.

ACTIVITIES:

- What does "sustained yield" mean?

- Referring back to the life cycles and WNS on Salmon, Halibut and Dolly Varden, figure how many of the eggs each lays will grow to be adults. A King Salmon, for instance, lays 8,000 eggs; if 1% survive to adulthood how many is that? How many will have to escape all the fishermen and spawn in order to "sustain" the "yield"?

- Note that closed or limited seasons for both fish and crab generally are in the summer. Why is that?

- Have students read and summarize the fishing rules for their area. Try to decide why each rule was made.

- Interview a Wildlife Protection Officer about their experiences during fishing season.

- Visit stores that sell gear and ask the salesperson to explain and/or demonstrate some different types.

- Take a walk on a dock and inventory the boats seen (gill netters, seiners, trollers, cabin cruisers for sport

- You could invite fishermen into class (or take the class to his/her boat) to share experiences and expertise.

- Make a cartoon about "the one that got away."

- Have someone demonstrate ways of cutting and baiting with herring.

Many school students are involved in sport fishing and perhaps during SeaWeek they could share their expertise with other students.

FIELD TRIP -- SALMON STREAM

This field trip, based on materials developed and used in Juneau by Dick Mariott, a biologist with the Alaska Department of Fish and Game, is designed to establish a concept of rearing and spawning habitat for fish. The activity includes counting the fish the students see in a salmon stream. A record of the count can then be kept and compared with previous years to determine whether there have been increases or decreases in the fish population in one stream as recorded by 5th grade students. Students should discuss possible reasons for population fluctuations before the fieldtrip and again after.

Materials Needed:

1. Record chart and pencil for each two students (sample on following page)
2. A few salmon egg clusters in a plastic bag - one bag for each two students(secure from fisherman, cold storage, fishing supply store or Alaska Department of Fish and Game)

Personnel Needed:

1. Fisheries Biologist, if possible
2. Knowledgeable junior high, high school or college student assistants(at least two.)
3. Interested parents

Student Preparation:

1. Students should study the information on Coho Salmon and Dolly Varden in the Fish and Game Notebook Series and the Life Cycle Material on these two fish -- these are found in the Curriculum guide. Discuss what is meant by spawning and rearing areas.

2. Students should know some of the reasons for fish population changes:

   A. Natural predators: bears, eagles, gulls
   B. Other Natural causes: low water, extreme cold
   C. Man caused changes: a. pollution, b. people and domestic animals trample area, c. people catch spawning fish by snagging, etc., d. trees are cut which raises water temperature and erosion, e. wells and other uses of water lowers the ground water level. (Since this lowers the stream flow, cohos may not be able to travel upstream). f. people may possibly request to change the course of the stream, g. remove gravel from stream bed, h. fill stream bed, i. build dams

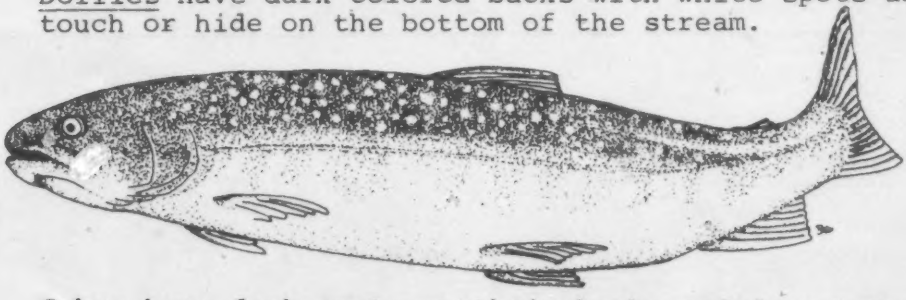
Stream Site Selection and Preparation: (In the spring not before mid-May)

1. Select a stream where Coho Salmon and Dolly Varden spawn where you can see the bottom. Look for a stream that has the following characteristics:
   a. Size - less than 15 ft. wide and less than 1½ ft. deep.
   b. Water - clear
   c. Bottom - gravel
   d. Banks - sloping downward, not overhanging. (Fish may hide under an overhang.)
2. Before the field trip use flagging or signs to divide the stream into known lengths. (100 ft. works well) There should be enough lengths for each 2 students in the class to count the fish in one pre-marked length.

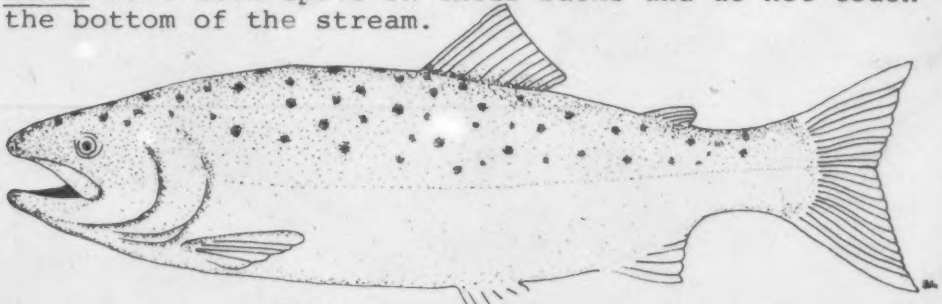
Salmon Stream Trip:

1. When the students arrive show them how to identify the fish to be counted - precaught fry or fingerlings in glass gallon jars kept in the cool water of the stream would be very helpful - students should also be able to see and identify fish in the stream before the count. The following characteristics should be pointed out:

Dollies have dark colored backs with white spots and touch or hide on the bottom of the stream.



Cohos have dark spots on their backs and do not touch the bottom of the stream.



Fry are less than 1½ inches long. Fingerlings are larger and harder to see because they hide.

2. Divide the class into groups of two and give the following instructions:

   Start at the downstream mark of your length (you will be shown where to start) and walk very slowly upstream (being careful not to muddy or knock things in the water) to the marker at the upper end of your length, counting and recording the number of fish you see. Record on the sheet which is being handed out. (20 to 30 minutes).

   FISH RECORD

   Class _____ Area _____

Salmon (Black Spots - off bottom)	Dolly Varden (light spots - on bottom)
Fry (small fish	Fry
Fingerling (larger)	Fingerling

   You have also been given a plastic bag with fish eggs in it. When through with your section walk back to the deeper pools. Stop and place a few salmon eggs in the upstream edge of the pool where the smell of the eggs will wash downstream and attract larger fish. Remain very still and count these larger fish that come out to feed on the eggs. (5-10 minutes per pool)

   When you have finished your count return to the regroup area and turn your completed record sheet in to your leader. He will total all of the record sheets to determine how many fish have been seen today. THIS IS NOT A CONTEST TO SEE WHO CAN COUNT THE MOST FISH. The counts made each year will be compared with counts from other years to determine whether the population is increasing, decreasing or remaining the same. For this reason accurate counts are important.

3. When all of the students have returned to the regroup area the following topics could be discussed:

   A fisheries biologist or other informed person could talk about other ways to trap and count fish...minnow traps, electro-fishing, pre-emergent sampling, face mask counts and sight estimates in schools of fish.

Discuss the economic value of a small stream. If only 50 coho salmon and 60 chum salmon spawn in a stream, about 10 times that number (their young) are caught by salmon fishermen. Each fish is worth about $10 to the fisherman, so the stream produces about $10,000 worth of fish every year. Other values such as recreation, food for wild animals and education can be derived from a salmon stream.

Discuss condition of stream - identifying desirable habitat: Clean water, overhanging banks to provide feeding and hiding places, trees and other vegetation to help keep the stream cool and keep the banks from eroding. Discuss destruction of the habitat if there is any evident.

Discuss how to maintain and improve stream habitat.

Leave "green belt" natural areas along streams.

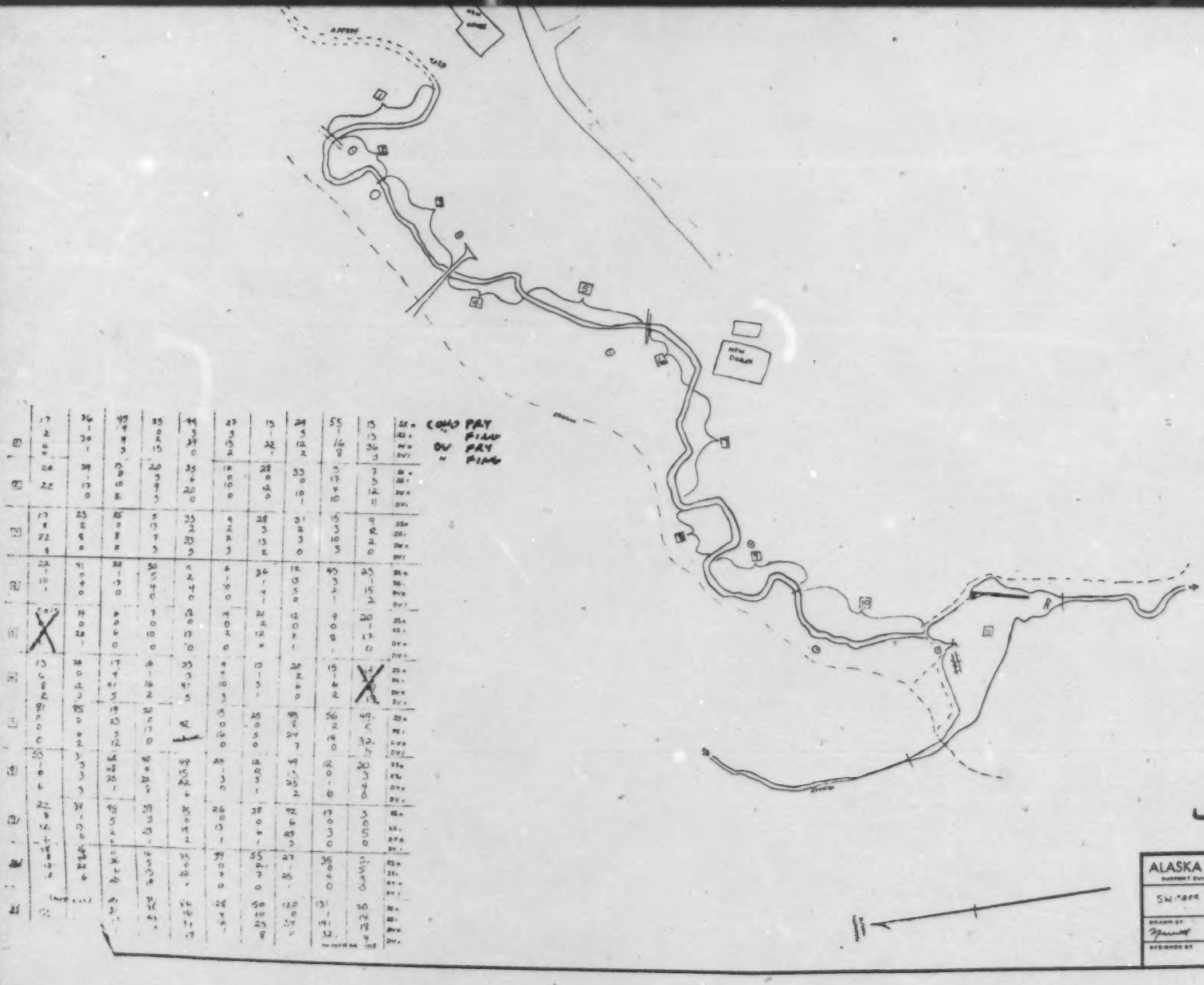
Do not build houses right on stream banks.

Do not silt up streams with road crossing or block fish movement.

Know and follow sport fishing regulations.

Clean garbage from streams. (emphasize that removing logs and branches may help species of fish that need lots of spawning area (pinks, chum) but harm species that need lots of rearing area (coho, dolly varden.)

MAP OF STREAM AND TOTAL COUNT FOR EACH LENGTH



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Relevant Books:

- How to Fly-fish for Salmon, by Bruce Colegrave, 1971
- Story of the Pacific Salmon, by Julie Crandell, 1941
- About the Biggest Salmon, by Henry Luhrs, 1961 (Oregon fish)
- History of Marine Hatcheries of Alaska, by W. Hunt. 1976 (gov. doc.)
- Salmon: Our Heritage, Vancouver British Columbia Packers, Ltd., 1969
- The Salmon: Their Fight for Survival, by Anthony Netboy, 1973
- Red Tag Comes Back, by Fred Phleger, 1961
- How Fish Live, by Peter Whitehead, 1975
- Attract A Fish, by (OBIS) Outdoor Biology Instructional Strategies, Lawrence Hall of Science, U of Calif., Berkeley, Calif.

Relevant Films:

- "Environment and Survival - Life in a Trout Stream"
- "Fish and Their Characteristics"
- "How do They Move" (about all kinds of creatures)
- "How do Fish Swim"
- "Looking at Fishes"
- "North Pacific"
- "What do They Eat"
- "Wonders of Reproduction"
- "Sharks' (Cousteau film)
- "The Stream"
- "My World - Water"
- "Way of the Trout" (call Sport Fish Division, ADFG, Subport Bldg., Juneau)
- "Salmon - Life Cycle of the Sockeye"
- "Salmon - Catch to Can" (covers fish, fishing and canning)

(films, cont.)

- "Adaptation to a Marine Environment"
- "Tragedy of the Red Salmon"
- "The Salmon Story" (life cycle and processing)
- "Kodiak Island" (interrelationships)
- "Living River" (Sport Fish Division, ADFG)
- "Aquatic Ecologist" (Sport Fish Division, ADFG)

(If not otherwise stated, books and films are available from the State library.)

TEACHER INFORMATION
FOR
SEA WEEK CURRICULUM MATERIALS

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FIFTH GRADE

Name of Sea Week Materials	Contents and/or Use
ACTIVITY BOOK	
Worksheet # 1 - Splash *	Writing
Worksheet # 2 - Splash *	Writing & Discussion
Life of the Salmon **	Coloring Book

* 'Splash' Game may be ordered from:

National Park Service
709 W. 9th St.
Juneau, Alaska 99801

** "Life of the Salmon" may be ordered from:

National Park Service
709 W. 9th St.
Juneau, Alaska 99801

Worksheet I - "Splash"

Splash! a game about salmon

Directions: Using the game, "Splash", complete the following:

1. Name 4 things that are helpful to fish in their natural

   1. _____

   2. _____

   3. _____

   4. _____

2. Name 4 situations that could be harmful to fish in their natural habitat.

   1. _____

   2. _____

   3. _____

   4. _____

3. Name 4 situations - man made- that are harmful to fish.

   1. _____

   2. _____

   3. _____

   4. _____

Worksheet II - "Splash"

Splash! a game about salmon

I. Using "Splash", pretend you are a fish and write your life story beginning with the spawning pool.

II. Take one of the following areas, and from the fish's point of view, tell about the situation in which you find yourself.

A. You are a just spawned fish in a shallow river three miles from the ocean. Make up a story based on facts, about how you find food, protect yourself from predators (larger fish like Dolly Vardin) and about your trip down the river to the salt water. Remember the small water falls, white water, rocks and swift currents that could give you trouble on the trip down river.

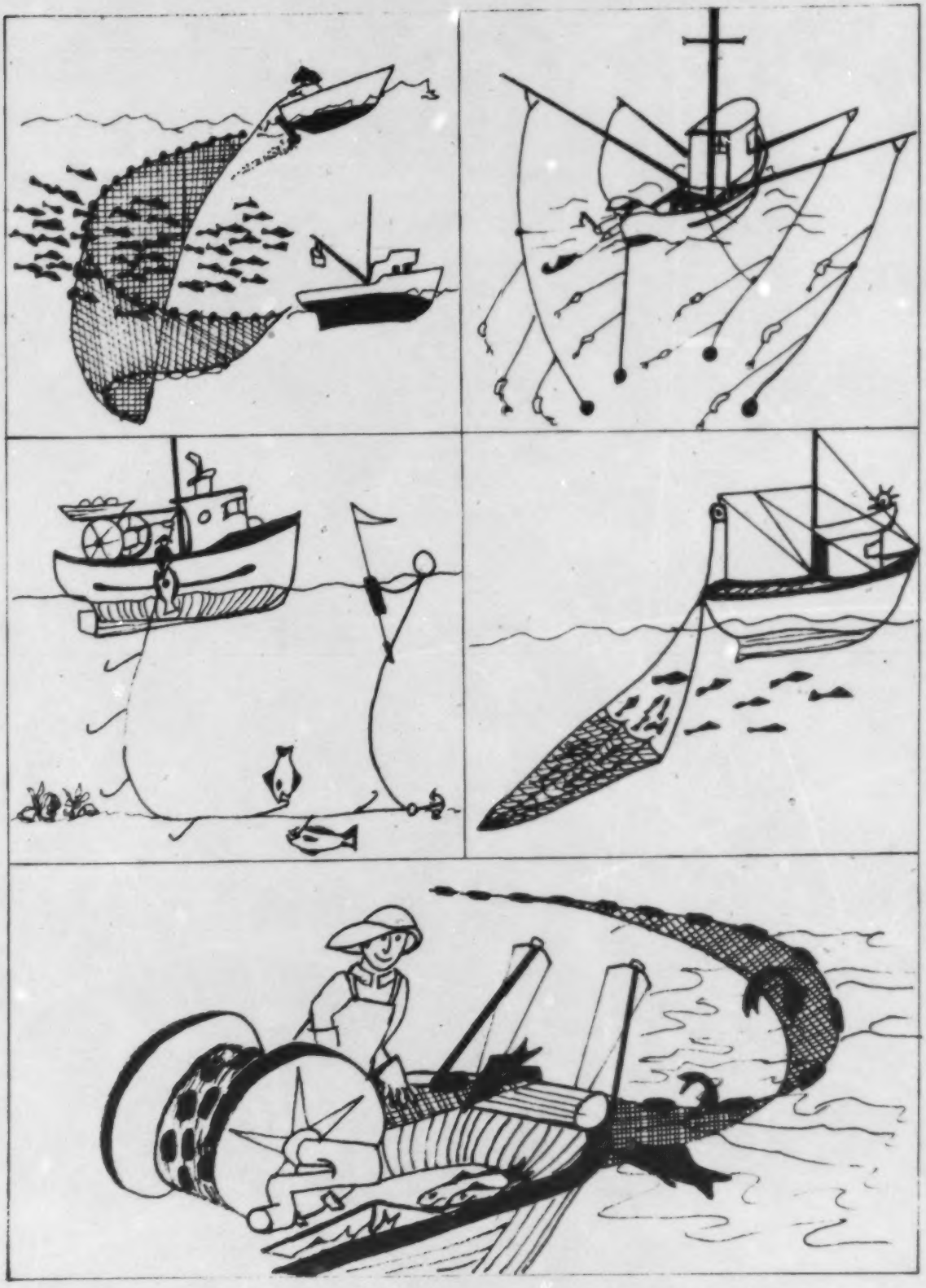
B. You are a salmon about to be caught by a fishing boat - Tell how you would escape or tell how you are caught.

III. Trace the progression of the salmon from the fisherman to the dinner table.
1. a fresh fish
2. a canned fish
3. a sport fish
4. a frozen fish

IV. Explain how waste from factories, fertilizers and oil tankers pollute the fish's environment.

V. Explain how a sport fisherman catches a fish.
1. spinning rod
2. fly fishing
3. bait casting

VI. Explain how a commercial fisherman catches a fish.
1. Troller (power or hand)
2. Purse seiner
3. Gill netter



STEPS TO ORGANIZING A SEA WEEK IN YOUR COMMUNITY

I. Familiarize yourself with the Sea Week curriculum and introduce it to other interested teachers and parents.

II. Catalog the resources in your area. Where are the good beaches? When are the good low tides? Are there any agency, hatchery, or museum personnel that would be available as speakers and/or for field trips?

III. Draw up a well-thought out plan for Sea Week and present it to your administrators for approval.

IV. Talk to teachers in the upper grades about having some of their students accompany you on your field trips. Brief them ahead of time as to the activities you'll be doing.

V. Make up a calendar of when speakers will talk, which movies will be shown, and when each class will take their field trips. By arranging two field trips near one another in location, or by having the second class come to the beach when the first field trip of the day is leaving, gas (and energy) can be saved by having fewer bus trips.

VI. Invite the whole community to participate - parents, chamber of commerce, governmental agencies, native corporations, fishermen, etc. Parents can assist with field trips; businesses might display student artwork. If community organizations are interested, the week can become a Festival of the Sea, with boat tours, movies, speakers, games, and dances. Contact your local paper about featuring Sea Week with a photo and story - beforehand, during, and afterwards! Radio stations might want to interview field trip leaders - or read stories that students have written.

VII. Spend an entire week studying the amazing ocean! Math problems, writing assignments, spelling words - can all relate to our marine environment. Show your students the wonder of sea life!

SUGGESTED FIELD TRIPS

In planning field trips for your class two things should be considered: 1. The emphasis in Sea Week studies at your grade level. 2. The available community resources.

Consider visiting a place - beaches, docks, vessels (fishing, pleasure, ferry, barge, tour ship, Coast Guard), cold storage plant, canneries, supermarket, government research facilities, hatcheries. Museums, private collections and stores might be considered for indoor trips. Arrangements might be made to watch someone at work - fisherman, biologist, or Coast Guard personnel. If your students have an opportunity to visit another community you might include Sea Week activities in your itinerary or might include the entire trip around them.

In planning any trip, if possible arrange for knowledgeable persons to accompany your group. The involvement of interested parents is also valuable.

FIFTH GRADE

I. Beach - Study tidepool fish. Feed and observe blennies, sculpins, flat fish.

II. Stream - Enlist the help of a knowledgeable agency or individual. A recommended census of fish fry is in the guide.

III. Fishing Industry - Visit fish hatchery, cannery, cold storage, fishing vessels,

IV. Coast Guard - Visit the fisheries patrol.

V. Fish And Game - Have program on fishing regulations, enforcement, and habitat protection.

VI. State Museum - A unit on fish is available on a loan basis.

WHAT TO DO ON THE BUS

Put together a checklist of objects (or use the one that follows) that the students may see at the beach. During the bus ride, students can circle the name (or picture) of each object that they think they will be seeing during the field trip. At the beach, they can check off the objects they actually saw, and estimate or count how many they saw. A Juneau teacher makes her checklists into a small book, with a pencil attached by yarn, and gives each pupil a sandwich bag in which to store his/her checklist.

bus	_____	cow	_____
can	_____	raven	_____
fish	_____	sheep	_____
tree	_____	driftwood	_____
gull	_____	boat	_____
buoy	_____	moose	_____
anemone	_____	dock	_____
whale	_____	starfish	_____
seaweed	_____	house	_____
crab	_____	airplane	_____
bottle	_____	fisherman	_____
jellyfish	_____	limpet shell	_____
sand flea	_____	sea urchin	_____
mussel	_____	porpoise	_____

CONSERVATION

Conservation may be defined as the "wise use" of our natural resources. It is not the non-use of them, but rather a use that comes after careful thought has been given to the reasons and consequences of that use.

It is perhaps trite to say that with increasing population pressures, the ever-increasing need for raw materials, for recreational facilities, for homesites, etc., pressures increase on a natural environment that may previously have been untrammeled and in no need of someone to protect it from total alteration. Here in Alaska, particularly, the residents of the State are faced with making many immediate far-reaching decisions about the natural environment of our State. What man's impact on it will be and if and how that impact should be limited or controlled are some of these decisions.

Conservation, practically, comes down to a few important principles:

1. Every living thing, as well as non-living thing, has a place and function in the balance of existence on the surface of this planet, whether or not we happen to know what its precise niche is. "Everything is connected with everything else." "Everything affects everything else." Destruction of one species, useless and unimportant though that species may seem to our ignorance, can have wide-reaching repercussions.

2. Natural resources are exhaustible. Populations which drop below a critical threshold cease to reproduce and the species plummets into extinction. Energy resources on earth are not renewable. Extinction of living species and exhaustion of non-living resources are natural processes. Trilobites went extinct before men appeared on the scene. Volcanoes spew noxious gases into the air. Nevertheless, the speed with which man, especially 20th century man, is destroying or using up extant life and resources is astronomical compared to natural processes.

3. Since man is an intelligent being, he can, if he will, desist from extinguishing life and exhausting the resources of the earth. Man can practice conservation without denying himself a full and enjoyable life. His reason for using resources wisely may be an idealistic appreciation of all that nature has and is, or it may be a realization that our tomorrows will be poorer unless wisdom regulates usage of our goods.[1]

For school children studying Alaska's marine life, conservation involves a few simple, yet extremely important principals:

1. DO VISIT THE BEACH AND ENJOY YOUR TIME THERE BUT WHEN YOU LEAVE, LET THE AREA BE THE SAME, OR BETTER, THAN YOU FOUND IT.

2. IF YOU TURN OVER A ROCK TO SEE WHAT IS HIDING UNDER IT, TURN IT BACK OVER WHEN YOU HAVE FINISHED. (What lives there may depend for survival on the exact kind of micro-habitat that exists under that rock.)

[1] Reef and Shore. Hawaii Nature Study Program for Elementary School Children, p. 4.

3. IF YOU PICK UP ANIMALS FOR CLOSER VIEWING, DISTURB ONLY THE ONES YOU WANT TO LOOK AT, HANDLE THEM CAREFULLY, THEN REPLACE THEM WHERE YOU FOUND THEM. SEA CREATURES CAN LIVE OUTSIDE OF THE WATER ONLY BRIEFLY. A PAN OR BUCKET OF SEAWATER WILL ALLOW CLOSER EXAMINATION AND REDUCE STRESS ON THE ANIMAL. KEEP THE CONTAINER OUT CF DIRECT SUNLIGHT AND REPLACE THE WATER IF IT BEGINS TO WARM. HANDLE FISH WITH WET HANDS TO PRESERVE THEIR PROTECTIVE SLIME AND IN HANDLING CRABS AND JELLYFISH - WATCH OUT FOR STINGERS AND PINCHERS. PICK CRABS UP FROM THE BACK AND SUPPORT THEIR UNDERSIDE WITH THE PALM OF YOUR HAND. DON'T TOUCH JELLYFISH.

4. IF YOU WANT TO USE LIVE MATERIALS IN THE CLASSROOM AFTER THE FIELD TRIP TO THE BEACH, TAKE ONLY WHAT YOU WILL NEED, TAKE CARE TO KEEP IT ALIVE, AND RETURN IT TO THE BEACH WHEN YOU ARE FINISHED WITH IT.

5. NON-LIVING BEACH MATERIALS MAY BE COLLECTED BUT USE MODERATION HERE, TOO. IF MATERIALS ARE FOR CLASS USE, HAVE A PROJECT IN MIND BEFORE YOU BEGIN COLLECTING AND THEN GATHER ONLY WHAT YOU WILL NEED. YOU MAY WANT TO GATHER DRIFTWOOD, STONES, BITS OF POLISHED GLASS. UNLESS YOU ARE A SECOND GRADE TEACHER, HOWEVER, PLEASE COLLECT ONLY A FEW, IF ANY, EMPLY SHELLS LEAVING THESE MATERIALS FOR THE SECOND GRADERS WHOSE ONLY SEA WEEK BEACH AND CLASSROOM ACTIVITY IS STUDYING THEM.

A CHECK LIST

FOR

A FIELD TRIP TO THE BEACH

You the teacher:

1. Be sure you are personally familiar with the beach to which you and your class are going. If you have not been there before, take a bit of time after school or on the weekend to go to that beach and walk it carefully. By being familiar with it yourself, you can anticipate what your students will be able to see and do there.

2. Check carefully on all bus arrangements for your class. Be sure that a bus is scheduled for you and be aware of the delivery and pick-up times.

3. Arrange for adequate adult supervision. Usually there is no problem in finding parents willing to go along. Often junior or senior high school students may also be available and, if they are taking biology or other related science courses, they can be very helpful. One older student or adult for every five or six children would be a good ratio in terms of safety, control, and learning.

4. Give careful thought to what you will do with your time at the beach. The beach is an exciting place just to explore, but some thought and directions given to the activities to take place will make the experience richer and more profitable for students and you, too.

5. Meet - or at least talk by phone - with your volunteers before the field trip to acquaint them with your plans for the outing. Be sure that each of them knows specifically what you would like each to do. Recommend that they attend appropriate training workshops and provide them with information from this guide or elsewhere.

6. Well in advance of the beach trip itself, begin preparing your students for their experiences there. The better prepared they are, the more successful the field trip will be.

7. Letters should be written to all parents, including permission slips, so that parents know about the activities in which their children will be involved.

8. Collect and ready all materials you will need for the field trip - buckets, pans, binoculars, camera, whatever it is you need. You might consider bringing or arranging for some kind of snack at the beach - a big bag of gorp (M & M's, raisins, salted peanuts, etc.) always makes a hit and a snack can serve

to reorganize matters at the beach and create a natural (though slightly contrived) change of pace and focus. (see the suggested time plan that follows.) Be sure to take along a supply of bandaids - or better yet, a small first-aid kit - just in case there is a need for it.

9. Plan the trip ahead, but allow for flexibility. If a whale is breaching just off shore while you are trying to teach the life and ways of a barnacle, your students will not be absorbing much of your lecture. Be prepared to take advantage of those special events that occur so often along our shores.

The students:

1. Involve them in preparing for the field trip as much as possible.

2. Explain to them any rules for field trip conduct. Stress especially the fact that the beach is a special environment and a fragile one whose beauty comes from the LIVING plants and animals to be found there. Impress upon them the need to respect the life forms they will see, to leave the beach as nearly like they find it as possible and not to collect or molest live beach animals unless you, the teacher, have very specific and well thought out needs for limited quantities of live animals and materials for use in further teaching processes and have requested the students help you gather materials.

3. A quick talk about safety at the beach would not be out of place - the need for proper clothing, care to be taken on rocks that are slippery when wet, what to do in case of injury, always keep an eye on the tide to be sure you are not stranded or lose gear to the rising waters, etc.

4. If a class project is planned for the beach time, help students to prepare or gather materials they will need to take with them.

BOTH teacher and students:

BE PROPERLY DRESSED. It is always difficult to predict what the weather will be in coastal Alaska but there is often a good chance that there may be rain. Be sure everyone knows that he or she should come dressed warmly and prepared for rain if that prospect seems at all likely. Wearing layers of clothes always makes sense - a short sleeved shirt, then something with long sleeves, topped by a sweater or warm jacket and something water and wind-proof. Foot gear is important. Layer socks for maximum warmth and wear RUBBER boots if possible. Carrying a back pack is a good idea for students and teachers alike. It leaves your hands free, lets you store away layers of clothes you want to shed or don't need at the moment and is a good place to keep the snack you and/or the students have decided to bring along.

SUGGESTED ON-SITE ORGANIZATION

The beach is an exciting place on your first visit there or your five hundredth and the most normal and natural thing to do on the beach is to walk - or run - along the shoreline to see what is there for the finding. If your class has been working hard on sea related studies and has carefully outlined what they want to do with their time at the beach, then perhaps all students will set right to work with whatever tasks have been outlined beforehand. But, if a less structured approach seems to be in order, you might try the following idea...

Part I

If, before the beach experience, you have been working in the classroom with the students on the particular area of marine knowledge outlined for your grade level, then the students should have a good idea of particular concepts or kinds of life or situations they might look for at the beach. Students could have the first half of the time at the beach to apply their knowledge in a free kind of framework. That is, for example, if you are a second grade teacher and have been studying shells with your students, give them the first part of their time at the beach to see how many different kinds of shells they can count, or give them some other similar kind of task that they can carry out and at the same time still be free to explore other aspects of the beach.

Part II

At the mid-point of your allotted time at the beach, gather the children together. Taking a bit of time out to open that big bag of gorp, or gathering for some other kind of snacking, works to draw everyone together, change the pace and focus.

After the quick energy break is a good time to have the students sit down quietly and talk about what they have seen or to have adult helpers work in small groups with children to share further discoveries or knowledge about materials found on the beach. As an example, if you are a first grade teacher who has been studying marine animals with your class, each adult helper might have been assigned to gather in a bucket - with the children's help - examples of a particular group of animals during the first part of the time on the beach. Then, during the second half of the beach time, each adult and his or her bucket of materials might circulate from one small group of children to the next, encouraging them to touch, feel, observe certain characteristics or qualities of these particular animals.

Children need both to enjoy the beach just for the pleasure there is in being there and to grow in understanding the complex web of life and environmental factors that are at work there. If careful thought and planning have gone on well before the actual trip to the beach, there is every reason to believe that both these goals can be accomplished.

A LOOK AT THE BEACH

Any beach is as individual in its own way as are we who, as individuals can be distinguished from all other people. Just as each of us represents only one combination out of the many possible, so it is with beaches. A beach is a place where the sea confronts the land, and every aspect of that sea and that land edge is important in determining what the general appearance of that beach will be and what kinds of plants and animals will grow and thrive in that particular environment. Many factors combine to determine the personality of that unique and special place.

The Sea

If we think first about the water at the beach, we realize that there are several ways in which it can vary. To begin with, for example, those of us living in the Juneau area look out to waters that are relatively protected. That is, our beaches are not subjected to the open, powerful swells that are common on coast lines that abut the open ocean. Unlike conditions that might be found at Sitka, for example, the wave conditions along our beaches are always relatively mild and non-violent. Even in the Juneau area, however, local differences in topography influence the personality of the beach. Whether a particular beach area is a straight, uninterrupted stretch, a deep or shallow cover, or a jutting point will influence the force and effect of the waves upon the shore. Consequently, we might expect to find different kinds of life on a point, in a cove, or on a straight, uncomplicated shoreline because each species has a particular ability to withstand greater or lesser wave force.

We all know that the sea is salty but we may not all realize that the concentration of salt in sea water can be highly variable. In the open ocean, salt concentrations measure about 32 to 33 parts per thousand. In our inside waters around Juneau, the average salt concentration in main channels may be slightly less than that because of the greater influence of fresh water entering from streams and rivers. At the mouths of the streams and rivers themselves, where salt and freshwater mix, salt concentrations are very low. Because each kind of marine plant or animal has its own built-in tolerances to varying saltiness or freshness, these living populations vary with the salinity prevalent at a particular place.

THE SIZE OF PEBBLES

If you stand on a beach and look thoughtfully at it, one of the first things you will notice is its texture - whether it it sandy, gravelly, composed of cobbles, bedrock, mud or a combination of two or more of these. The nature of the beach is critical in determining what can live there. Let's examine each kind of substrate in turn to see what kind of life we might expect to find.

Mud

Mud can be anything from relatively porous sand-soil mix to the clay muck that sucks rubber boots right off your feet. If you look at the surface of this kind of substrate, you will be aware of little, if any, life. Here and there you may see the flexible tubes of mud dwelling worms sticking up an inch or so above the surface. Or you may see "cake decorations" left by other burrowing worms. Finally, you may be aware of the presence of clams by the squirts of water and the siphon holes in the mud. Digging with a shovel will reveal the various inhabitants of the mud in all their glory - fat, bulbous peanut worms: slender, earthworm-like nemerteans of various descriptions; many-legged annelid worms; and hardy bivalves.

Sand

Because sand is more porous than mud, it is a better surface for many burrowers, a better surface for a wider number of animals to live on and in. On a sand flat at low tide one may find starfish, sea urchins, and numerous kinds of crabs and snails. Some of these animals wander over the sand flats when they are submerged, scouring them for bits of food. Some crabs, like the Dungeness, tend to stay in sandy areas because of the methods of self-protection involves burrowing into the sand to hide. (Even when the sand is exposed, watch for depressions in the surface that mimic the shape of the crab's shell. By digging there, you may uncover a crab that stayed buried even as the water receded.) By looking for clam or cockle siphon holes, you will discover these common residents of sandy areas and by digging carefully you may unearth them.

Cobbles and Boulders

Obviously, the size of loose rocks on the beach may range from something just a bit coarser than sand up to boulders too large to be lifted. In general, the larger the general size of the rock pieces, the greater variety of life one might expect to find there. The more stable the hard surface is, the greater protection and anchors it can afford a resident plant or animal. Intertidal areas of cobbles or rocks are often most obviously serving as anchorages for marine plants (most common in the Juneau area, Fucus, the rockweed, the tough, ubiquitous, brown plant with the bulbous reproductive bodies that kids like to pop) and for barnacles and blue mussels that may cover certain rocks of sections of beach in great density. If you begin to look down among the beds of rockweed, barnacles, and mussels and UNDER cobbles and boulders, you will discover an amazing diversity of life forms. Small six-rayed starfish cling beneath medium sized rocks, often brooding clutches of eggs. Blennies up to six inches or so in lenth (one of the two most common intertidally discovered fish) hide under rocks. So do amphipods or sand fleas and tiny crustacean beach scavengers that quickly seek new cover when discovered under their protective rock. Clinging to the surface of the rocks may be limpets, chitons, sponges. Look for the latter particularly under overhangs of larger rocks.

Because of their ability to serve as anchors and because they offer so many protective niches, rocks on beaches afford some to the best looking places. Don't neglect to have along a magnifying glass so you can really see some of the tiny critters! Guaranteed that the more your look, the more you will see there! Just be very sure that after you turn over a rock to reveal its underside residents, that you replace it so the animals don't dry out and perish!

Bedrock

This is just as exciting a place to poke as cobbles/boulder areas and many of the same inhabitants can be found here - with two general kinds of exceptions. First, obviously this rock surface can't be turned over so the "rock and sand or mud residents" are not here. Second, it is in bedrock areas that you are most apt to find remnant puddles of water - tidepools - that may harbor lots of life, including small anemones with tentacles extended to trap food (they come in a wide variety of gorgeous color combinations), rock hard coralline algae that looks like hard, pink plaster but are actually living plants, tiny immature sculpins, and perhaps little shrimp. Be sure to look carefully in crevasses for sponges, starfish, and other creatures.

THE DISTANCE FROM THE WATER

Each species of marine plant and animal has a particular tolerance to being out of salt water. Some of them, for example, are never found intertidally because they have absolutely no tolerance for exposure to the effects of an air environment. Others can stand being out of salt water for extended periods of time, needing only to be wet by the sea on occasional very high tides. By looking at the beach in a section from its highest high water mark down to the water level on a low, low tide, you can quickly begin to see major differences in plant and animal populations.

The Highest Fringe

At the upper limits of the intertidal zone, least life forms are evident. You may notice that the rocks appear black here. This is because they are covered by a black encrusting lichen or by a blue-green algae that makes these rocks treacherous and slippery when wet. In these upper reaches, too, may be found the common tiny periwinkle - a fat, ridged snail that sometimes seems to pepper the rocks.

The Middle Zone

As you move down toward the water's edge on a low tide, you will be aware of obvious color bands or patches on the beach. There may be banding of Fucus, the common brown rockweed, and of blue-black mussels (the intertidal - and subtidal - bivalve that attaches itself by tiny threads to rocks and pilings and other surfaces), and barnacles. Here too you will begin to see limpets (the species of which are sometimes most quickly identified by how low or high they are found on the beach), amphipods, various starfish, tiny black sea cucumbers, and other forms of life there were not in evidence at higher levels.

The Lowest Zone

As you approach the water's edge, you will not find some of the plants and animals that were evident at higher levels. In general, however, the lower you go in the intertidal zone the greater the diversity of life forms you will find. Here you will find sea urchins, a wide variety of often large starfish, perhaps juvenile king crabs, large white or varicolored sea anemones (if they are out ot water, these will look like squishy, uninviting blobs, but look out into the shallow waters to see the same animals in all their expanded glory), and the larger snails.

So...as you look at any particulat beach for the first time, there is a great deal to think about. Remember that each part of the beach, each kind of surface type, each height from the water, each kind of topographical variation indicates what life may be found there. In general, it is advisable to spend the lowest part of the tidal cycle closest to the water's edge for in that way you will have the maximum amount of time to spend along the beach area that is revealed to us least often and which tends to harbor the greatest diversity of plants and animals.

If you can, acquaint your students with these obvious or subtle variations in the beach habitat for it will enrich their beach experience, too!!!

TIDES

Students can understand some basics about tides and should definitely learn that the height of the water on the beach varies with the stage of the tide and that maximum and minimum tidal levels vary each day.

Tides, in a very simplified kind of explanation, occur because of the gravitational pull of the sun and the moon on the earth. Just as the earth exerts gravitational force (why does an apple fall? why can't we step off into space?), so do these other two bodies. The force of the pull of the sun and moon on a particular place on earth depends on how directly they are in line with that place. The force they exert tends to pull the water away from the earth's surface on the side of the earth facing,thus causing a high tide. Because the relative position of the sun, earth, and moon are constantly changing in a cyclic rhythm, so are the tides.

Activities

Here in Southeast Alaska we experience a tidal cycle that consists of two unequal high tides and two unequal low tides each day. With some students in primary grades and all those in upper grades, you might sit down with a tide table and look at the numbers and explain what they mean. You might even make a simple chart of tide levels and of activities to coincide with various stages of the tide. For instance, it might be much easier to launch a boat when the tide is high but digging clams can best be done on the very lowest tide. Students might be shown the same beach at high and at low tide and through words or art work compare the differences.

Preparation for Field Trip

In preparing for the field trip, discuss tides with the students. Mention the need to be as close to the water as possible when the tide is at its lowest in order to see that strip of beach and the life that is there, for the water quickly comes in and covers it. Talk, too, about the need to be aware of the tide level and thus not to set a pack or bucket next to the water's edge and expect to find it there later if the tide is flooding.

As a teacher you need to be aware of the time of low tide when scheduling your field trip to the beach and in planning the activities that will take place there. The time of very lowest tide should be kept open for observation of what is to be found in the zone nearest the water. Activities such as taking a break for a snack or gathering around buckets to discuss and examine particular animals should occur when the tide is ebbing or flooding.

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Plus +++ check with agencies in your area, aquaculture associations, the U. S. Coast Guard, local corporations to see what publications they may have available.

OTHER LEARNING AIDS

The Alaska State Museum has multi-media learning kits available for use by Alaskan schools, including a Salmon kit. Priority use is given to bush schools. Write: Alaska State Museum, Pouch FM, Juneau, Alaska 99811.

Your school can order films through the Alaska State Film Library. Their marine science/oceanography listings are too numerous to mention, but some topics that are dealt with include: marine invertebrates, ocean currents, the beach, whales, life cycle of the salmon, mollusks, tide pool life, marine science careers, sea birds, octopus, the ocean as a food source, fishing techniques, the ecology of the ocean, and seacoast cultures.

The Smithsonian Institution is currently field testing a binder of estuary study activities ($9.68). Activities include: Beachcombing, Mapping, Barnacles, Build A Trap, Fish Adaptations, Fish, Marsh Muck, Crabs, Water in Motion, Menance Oil Slick, Oil Spill Cleanup, and Estuary 3-D Board. For more information write:

SEA (Smithsonian Estuarine Activities)
Chesapeake Bay Center For Environmental Studies
Smithsonian Institution
P. O. Box 28
Edgewater, Maryland 21037

Posters on beach safety and pamphlets on tides, whales, crabs, and other marine topics are available from the Oregon State University Sea Grant Marine Advisory Program. For a catalog and price list (many are free) write:

Extension Communication-Marine Advisory Program
Oregon State University AdS 422
Corvallis, OR 97331

ALASKA SEA WEEK EVALUATION FORM

computer code numbers

(1-4)

1. Town or village_____ (5)

2. Grade level_____ (6-7)

3. Number of students involved_____ (8-10)

You may need to review your Alaska Sea Week materials to answer these questions.

4. How many classroom (indoor) activities and worksheets did you use from each book?

Book (Grade level)	Number of activities	
Discovery (K)	_____	(11-12)
Sea Animals (1)	_____	(13-14)
Shells (2)	_____	(15-16)
Glacial & Intertidal Ecology (3)	_____	(17-18)
Birds (4)	_____	(19-20)
Fish (5)	_____	(21-22)
Man's Influence on the Sea (6)	_____	(23-24)

5. What is the total number of field (outdoor) activities used from the 7 books?_____ (25-26)

6. How many periods (1 hr. each) did your class spend on the Sea Week Program?_____ (27-29)

Please check the appropriate box to the right of each question.

	decidedly yes	yes	no opinion	no	decidedly no	
7. Were the Alaska Sea Week materials relevant to your curriculum?	___(1)	___(2)	___(3)	___(4)	___(5)	(30)
8. Did the Sea Week materials motivate students to improve their math, reading, & writing skills?	___(1)	___(2)	___(3)	___(4)	___(5)	(31)
9. Did the Sea Week materials upgrade your science program?	___(1)	___(2)	___(3)	___(4)	___(5)	(32)
10. Did students enjoy the Sea Week activities?	___(1)	___(2)	___(3)	___(4)	___(5)	(33)
11. Did students develop a greater awareness, appreciation, and respect for the sea?	___(1)	___(2)	___(3)	___(4)	___(5)	(34)
12. Did students develop decision-making skills necessary for resolution of marine issues?	___(1)	___(2)	___(3)	___(4)	___(5)	(35)
13. Was the material appropriate for your students' grade level?	___(1)	___(2)	___(3)	___(4)	___(5)	(36)
14. Was the teacher background section adequate?	___(1)	___(2)	___(3)	___(4)	___(5)	(37)
15. Were the teacher instructions helpful & complete?	___(1)	___(2)	___(3)	___(4)	___(5)	(38)
16. Were parents and other community members involved in your Sea Week?	___(1)	___(2)	___(3)	___(4)	___(5)	(39)
17. Were parents favorably impressed with the Sea Week Program?	___(1)	___(2)	___(3)	___(4)	___(5)	(40)
18. Did Sea Week help improve the relationship of the school to the community?	___(1)	___(2)	___(3)	___(4)	___(5)	(41)

19. Rate your overall feelings about the Sea Week MATERIALS on a scale of 1 to 5._____ (42)
(1=high; 5=low)

20. Rate your overall feelings about the Sea Week PROGRAM on a scale of 1 to 5._____ (43)
(1=high; 5=low)

(OVER, PLEASE)

21. How many teachers are in your school? _____
How many are using Sea Week materials? _____ (44-45)

22. Do you plan to introduce the Sea Week materials to other teachers? yes____(1)
no____(2) (46)

23. Do you plan to use the Sea Week materials again? yes____(1) no____(2) (47)

24. Would you be interested in attending a marine education/Sea Week workshop?
yes____(1) no____(2) (48)

If so, list your name and school address:

Name_____

Address_____

25. What other comments do you have? Are there any specific improvements you would suggest?

Please return this completed form to Jill Thayer/Belle Mickelson, Alaska Sea Grant Program, University of Alaska, Fairbanks, Alaska 99701.